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NOTES AND COMMENTS

The Training of the Biologist

The most striking feature of late in the study of animals, at least in this country, is the marked tendency of the orthodox school of teachers to break through the narrow bounds which have confined them since 'Biology' replaced the old-fashioned natural history and comparative anatomy. It is, indeed, strange that while the methods of Darwin have had such an immense influence upon the lines of advanced work and research, they should have had so little effect upon the curriculum of elementary teaching. As Prof. Miall well said in his recent address to Section D of the British Association, "the animals set before the young zoologist are all dead; it is much if they are not pickled as well. When he studies their development, he works chiefly or altogether upon continuous sections, embryos mounted in balsam and wax models. He is rarely encouraged to observe live tadpoles or third-day chicks with beating hearts. As for what Gilbert White calls the life and conversation of animals, how they defend themselves, feed, and make love, this is commonly passed over as a matter of curious but not very important information; it is not reputed scientific, or at least not eminently scientific." Finally, as to the inter-relationships of animals, the average graduate of the orthodox university school is in a state approaching blissful ignorance. He is usually led, if not actually taught, to look down with scorn upon the 'systematist.' He imagines he has mastered the whole of the principles of Biology before he has acquired the most elementary notions of generic and specific characters and the phenomena of variation.

There have been two noteworthy utterances on this subject during the past month, that of Prof. Miall in his Presidential Address already referred to, and that of Mr Walter Garstang in the last number of the *Quarterly Journal of Microscopical Science* (vol. xl., p. 211). Both urge that the time has arrived for some reform in the methods of elementary training, and we commend their plea

to the careful consideration of all teachers interested in the future progress of biological science.

Mr Garstang gives a practical illustration of the importance of the study of living animals in his interesting paper "on some modifications of structure subservient to respiration in Decapod Crustacea which burrow in sand." It is to this that his general remarks are prefaced, as follows:—

"A good deal of scepticism has been expressed in recent years by various writers as to the utility of the more trivial features which distinguish the genera and species of animals from one another. I do not think that such scepticism can excite much surprise if one remembers that the vast majority of 'biologists' are almost exclusively engaged in the study of comparative anatomy and embryology. The amount of attention paid to these branches of biology has long been utterly out of proportion to the scant attention devoted to the scientific study of the habits of animals and of the function of the organs and parts composing their bodies. With isolated and noteworthy exceptions, the only naturalists who seriously add to our knowledge of the latter subjects are those who travel in distant countries, and who are thus thrown into close relations with animals in their native haunts. Yet all the time there are thousands of forms living on our own coasts and almost at our very doors of whose detailed habits and life-conditions we know practically nothing. I venture to think that the time has come for consideration whether the subject of bionomics (in Prof. Lankester's sense of the word) should not receive more adequate recognition than it does at present in the curriculum of our universities. That such recognition would almost immediately produce effects in a rapid extension of our knowledge is certain; and the subject is invested with so much intrinsic interest, as well as with such important bearings on the problems of evolution, that I believe such recognition would also have the effect of attracting many students to the pursuit of morphology who at present avoid it as a region of mere comparative anatomy. . . .

"It must in any event, however, remain clear that the great problems which Darwin left us as his heritage, after so greatly illuminating them, are not to be solved by the exclusively morphographical researches which occupy the time and zeal of the great majority of naturalists to-day. Even in the best of hands such researches are capable of obscuring even the simple facts of structure which they profess to elucidate; while the study of the functional relations of parts, side by side with the anatomical elucidation of the parts themselves, provides not only the data for generalisations of intrinsic importance, but assistance of an invaluable character in the field of morphological criticism."

The Historical Method in Teaching Biology

Prof. Miall, in his Presidential Address, not only emphasises the importance of the study of living animals in a manner that will scarcely bear abstracting, he also adds another important suggestion, that too little attention is bestowed by biological teachers upon the historical development of the subject. Many students attend the lectures and demonstrations simply because they are compelled to do so by the college curriculum or by the exigencies of a certificate. Those who happen to have no preliminary inclination to the subject thus find many of the statements of bare facts dull, uninteresting, and useless for mental discipline. Suppose that that well-worn topic, the Alternation of Generations, is being treated. As Prof. Miall remarks, "the lecturer defines his terms and quotes his examples; we have *Salpa* and *Aurelia* and the Fern, and as many more as time allows. How can he expect to interest anybody in a featureless narrative, which gives no fact with its natural circumstances, but mashes the whole into pemmican? What student goes away with the thought that it would be good and pleasant to add to the heap of known facts? The heap seems needlessly big already. And yet every item in that dull mass was once deeply interesting, moving all naturalists and many who were not naturalists to wonder and delight. The Alternation of Generations worked upon men's minds in its day like Swammerdam's discovery of the butterfly within the caterpillar, or Trembley's discovery of the budding *Hydra*, which when cut in two made two new animals, or Bonnet's discovery that an *Aphis* could bring forth living young without having ever met another individual of its own species. All these wonders of nature have now been condensed into glue. But we can at any time rouse in the minds of our students some little of the old interest, if we will only tell the tale as it was told for the first time."

Of course, there are many practical difficulties in carrying out this suggestion. It entails much reading of ancient literature, which the ordinary teacher rarely sees. It trespasses upon the allotted lecture hours, already too short for the material to be treated. At the same time, if it succeeded in infusing a little more philosophy into our medical students and others, who are too apt to look upon the preliminary biological course as drudgery, it would well repay the additional labour involved in preparation.

The Times on Archaeology

The foregoing matters are of more or less professional interest. So also are the geological questions—the pre-Cambrian problems of

Canadian geology—treated by Dr George M. Dawson in his admirable address to Section C at Toronto. Sir John Evans' address as President of the British Association, however, is one to interest even the least scientific of the general public. It is a valuable expression of opinion of one of the foremost minds upon the question of the Antiquity of Man, and recent attempts in Europe to carry the human period backwards much further than the Palaeolithic gravels. As might be expected, Sir John Evans' opinions are conservative. The engraved Pliocene shell, *Pectunculus*, is dismissed with ridicule. For the asserted Indian Miocene man he accepts the explanation ably advanced in *Natural Science* by Mr R. D. Oldham; the form of the fractured flints of the Cromer Forest Bed he attributes to natural fractures; he wishes for more evidence as to the age of the beds which yielded *Pithecanthropus erectus*, and the claims advanced in favour of 'Eolithic' man from the high level gravels near Sevenoaks, he considers, as he did in 1890, to be still unproved. In all these points we regard Sir John Evans' scepticism as healthy; and as he is unquestionably one of the best living authorities on stone implements, his opinion must carry great weight. The asserted pre-Glacial man of East Anglia, based on implements supposed to have been found beneath the glacial deposits, the recent excavations by Mr Clement Reid seem to have conclusively disproved. And in the other cases referred to the evidence is either wholly discredited or still inconclusive.

The most remarkable expression of opinion called forth by this learned and calmly scientific exposition of the facts was an astounding leading article in *The Times*. Most of the scientific members of the staff of that paper seem to have gone to Canada, and the reactionary journalists apparently resolved to make the most of their opportunity. Accordingly, we read concerning archaeology, in the first leading article of August 19th, that—

"All its speculations upon neolithic and palaeolithic man are founded upon a single observation, as yet completely unrelated, save by the loosest conjecture, with any other portion of human knowledge. That observation is that flints, chipped or polished in a manner for which natural agencies do not seem to account, have been found in certain deposits at widely-separated points on the surface of the globe. That they were chipped by man as we know him is a mere conjecture. How they came to be so widely distributed is a question that baffles even the licence of surmise. Geology does not attempt to fix within a thousand centuries the age of the beds in which they are found; and geological speculations themselves rest upon assumptions which may be plausible

where all real knowledge is wanting, but which can never be scientifically verified. Attentive perusal of Sir John Evans' address itself suffices to show that archaeology is in no sense a science, but rather a recondite and remote branch of historical speculation."

This extract is long, but it is worth reprinting, since it is a sad reminder of how slowly knowledge of the elementary facts of science really spreads. After this, it is perhaps unnecessary to consider any of *The Times*' later criticisms of the President's address or of his proposed Imperial Ethnographic Bureau. It was, however, unfortunate that Sir John Evans should have prejudiced his proposal by suggesting that the work might be undertaken by the Imperial Institute.

The Mammals of the Lost Antarctic Continent

As soon as space permits, we hope to publish some further interesting contributions to our knowledge of primaeval man and the question of his antiquity. This month we go a little further back in the history of the mammalia, and print a translation of an important address to the New University of La Plata by Dr Florentino Ameghino, which is liable to be overlooked in its separate form in the original Spanish. We do not pretend to endorse his conclusions; we look upon some of them, indeed, as visionary speculations. But during the past ten years the brothers Ameghino have done more than anyone else—not even excepting the eminent Director of the Museum La Plata (Dr F. P. Moreno)—to elucidate the geology and the mammalian fossils; and Dr Florentino Ameghino, who is an accomplished zoologist and comparative anatomist, commands a respectful hearing, if only on account of the remarkable contributions he has made to our knowledge of the Tertiary mammals and birds. We have already referred to the progress of his researches on several occasions in *Natural Science*.

It is well known that, according to our present information, the chief types of the higher mammals all suddenly appear both in Europe and North America at the dawn of the Tertiary period. We are acquainted with old land surfaces of the late Secondary period in both countries, but hitherto we have not found a trace of the ancestors of the higher Tertiary mammals on any of them. Dr Ameghino now claims to have discovered these long-lost ancestors of the Cretaceous period in Patagonia. He believes in the theory of an Antarctic Continent, which split up at the beginning of the Tertiary period into South America, New Zealand, Australia, South Africa, and less important islands. Here he considers that the Mesozoic ancestors of the mammals were evolved. He believes that they first wandered into the Euro-Asiatic Continent at the end of

the Cretaceous period from South Africa, which then became directly connected with the lands of the northern hemisphere. These mammals passed directly from the Euro-Asiatic Continent by a land-bridge into North America. Then the isthmus of Panama was formed, and many of the later Tertiary mammals were able to wander back to the land of their primeval ancestors in the direction of Patagonia.

The theory is a pretty one, and we only wish the facts supporting it were more convincing; for some theory of this kind would explain many mysteries in the distribution of animals. For our own part, we cannot recognise the very antique and ancestral features which Dr Ameghino perceives in his '*Pyrotherium*-fauna' from Patagonia; but we must await the promised memoir in which the remarkable new mammals in question are to be fully described.

The Geology of Patagonia

The interest aroused in the age of the tertiary deposits of Patagonia will be still further fostered by a forthcoming paper by Mr J. B. Hatcher of Princeton University, who visited the district in 1896. Mr Hatcher has already recorded a few notes in the *American Journal of Science* for September. In south latitude 51° 31′ he discovered, near Cape Fairweather, a series of marine beds with a fairly abundant invertebrate fauna, overlying the Santacruzian formation, which in that locality are well-developed and full of fossil mammals. These Fairweather beds, as Mr Hatcher has named them, have been deposited upon an eroded surface of the Santacruzian formation, and consist of some 30 to 40 feet (as at present observed). The lower part is fine-grained, incoherent sandstone, the upper a coarse, loose, but in places an extremely hard conglomerate, which passes insensibly into the overlying Patagonian shingle formation, from which it can only be distinguished by the fossils it contains. The marine invertebrata, according to Prof. Pilsbury, point to a Pliocene age, but they do not promise to be of much service in determining the vexed question of the age of the Santacruzian beds. Mr Hatcher at present believes that the Fairweather beds are the equivalent of those beds discovered by Darwin in North-Eastern Tierra del Fuego, and provisionally referred by him to the Santacruzian beds discovered by Fitzroy at the mouth of the Gallegos river, and he has, in support of his view, fragments of crabs' legs very similar to those which occur in the bluffs of San Sebastian Bay. The general dip of the strata also lends colour to his deductions. We shall await with interest the more detailed report which Mr Hatcher promises.

The Sirenian Mammals

The want of all definite knowledge of the ancestry of the Tertiary land-mammals is strange. Our absolute ignorance of the origin of the marine mammals like the whales, dolphins, and sea-cows is still stranger. Marine deposits of the Cretaceous and early Eocene periods are recognised nearly all over the world, but not a trace of the Cetacea and Sirenia has been found in them. So far as known, these curious types appear fully evolved at the top of the Eocene.

Nor does embryology help us much. It has shed a little light upon the nature of the Cetacea; we might therefore expect some information from this source concerning the Sirenia. Thus far, however, the results are small, and Prof. Willy Kükenthal's new memoir on the Sirenia (in Semon's "Zoologische Forschungsreisen in Australien und dem Malayischen Archipel," vol. iv., lief. 1), which is one of the most important monographs issued during the past month, does not contribute much to the solution of the great problem. The available material, it is true, is small—only four stages of *Halicore* and six stages of *Manatus*—and only three chapters (external form, integument, and dentition) are published. It is a most important contribution to the facts of the case, and for this alone we must at present remain grateful.

The Origin of the Irish Fauna

Not only is it almost impossible as yet to fathom the mysteries connected with the dawn of the present order of things in the distribution of life on the various land-areas; it is very difficult to discover the routes of the migration and distribution of organisms even during comparatively modern periods. During the last few years, however, much attention has been paid to the relations of the existing faunas and progress made in the determination of their affinities. Among others, many Irish naturalists have discussed in a very interesting manner the relations of the fauna of their island, and have arrived at various conclusions, some of which may prove to be of permanent value.

Quite recently Dr R. F. Scharff, Keeper of the Natural History Collections in the Dublin Museum, has returned to the subject, and published an interesting paper in the *Proceedings* of the Royal Irish Academy (ser. 3, vol. iv., No. 3, 1897, pp. 427-514). The contribution is lengthy, and it is written in a somewhat disconnected style; and how the author gets from his premises to his conclusions is not always apparent. Dr Scharff argues that part of the Irish fauna lived in Ireland in pre-glacial times; that the lower con-

tinental boulder-clay is Pliocene; and that it is a marine formation deposited in a great sea which covered a large tract of Russia and Central Asia; that the Siberian mammals migrated into Western Europe to the south of this sea; and that the British Pleistocene fauna and flora do not indicate former Arctic conditions in this country. The range of subjects discussed in this memoir is considerable. The conclusions are startling, but only when considered apart from the statements on which they are based. "The occurrence in almost all the English boulder-clays of marine shells" is an example of Dr Scharff's sensational statements. The paper cannot be discussed in a short notice. Our chief fear is that Dr Scharff's speculations will prejudice the use of zoological distribution in geological investigation.

Franz Josef Land

Captain Robertson, the enterprising commander of the whaler *Balaena*, has given an interesting description of his voyage this summer to Franz Josef Land. His geographical discoveries are interesting. He found some new islands on the south coast, but his most important achievement was returning westward from Franz Josef Land along the 79th parallel of latitude. He thus passed over the site of the two famous islands reported by Johannesen and Andreassen in 1884; but he found no trace of them. The Norwegian seamen must, therefore, have been out in their reckoning. The sea this summer was exceptionally free from ice, and the polar pack had receded far to the north. Captain Robertson thinks that in such a ship as the *Balaena* the whole Franz Josef Land archipelago could be charted in a single summer. This opinion renders the results of the Jackson-Harmsworth expedition all the more disappointing so far as can be judged from the accounts already published. But now that the expedition has returned we may hope for a final account of its work by the members themselves. Perhaps this may remove the somewhat widespread prejudice roused by the unjust publication of private letters and the injudicious advertisement of the London agents. The expedition is said to have cost some £49,000. We hope Mr Harmsworth is satisfied.

Mimicry and Protective Colouration

The questions of protective colouration and mimicry have a perennial interest for naturalists and the general public. Now that the conclusions of Trimen, Bates, and Wallace are being dogmatically taught in magazine articles and popular books, it is only to be expected that they should begin to be discredited by some of the younger school of biologists, and several of the works attacking the

'orthodox' theories have been noticed in *Natural Science*. In defence of the old positions we notice a short paper by Mr F. M. Webster of Ohio, in the Report of the Entomological Society of Ontario for 1896 (pp. 80-86). The author minimises the value of experiments, tending to show that insects with 'warning' colours are not always distasteful. He points out that the fact that Prof. Plateau enjoyed feeding on the caterpillars of the magpie moth does not prove them palatable to more usual enemies. No insect is so familiar an example of 'warning' colour as the North American danaid butterfly, *Anosia archippus*. Mr Webster narrates an instance of a number of these butterflies being eaten by mice in Texas, and tells how he himself observed a colony of brightly-coloured cabbage bugs (*Margantia histrionica*) devoured by the same rodents. But he believes that mice must be very exceptional enemies to these species, and that the bright colours may be of 'warning' value to animals that eat insects habitually.

The same author in another paper (*Journal New York Entom. Soc.*, 1897, pp. 67-77) deals with the mental or instinctive factors in protective resemblance. It is well known that in addition to the form and colour of the insect, a special attitude or a position on some particular background of leaf or twig is essential to the perfection of the illusion. Mr Webster believes that such habits have not been developed without the action of some conscious will and intelligence on the part of the creatures concerned. He compares the young twig-like caterpillar to the human infant who has inherited none of the accumulated knowledge of his ancestors, though he has inherited an aptitude for learning.

The Effect of Civilisation on the North American Insect Fauna

Another subject of general interest, lately dealt with by Mr Webster (*Fifth Annual Report of the Ohio State Academy of Science*), is the effect of civilisation on the insect fauna of North America. In few other parts of the world has so rapid a change been made in the natural aspect of the country by the advent of the pioneer and the farmer, and the transformation of swamps and forests into cultivated fields has led to the extinction of many native species of insects. Some species, however, have adapted themselves to the changed conditions, while a considerable introduction of Tropical and European forms has been a direct result of the advance of civilisation. Mr Webster rightly lays stress on the importance of systematic observations on the natural history of new countries, wherever possible, before the balance of nature has been disturbed by the advent of the white man.

Aspidiotus

The San José scale (*Aspidiotus perniciosus*) is a subject of perennial interest to the American entomologists. Last year the U.S. Department of Agriculture issued a pamphlet by Messrs Howard and Marlatt on the spread of the insect in the States, and now from the same Department we receive a bulletin (No. 6 Technical Series) on the systematic position of the scale, and the structural points which distinguish it from its allies. This work is from the pen of Mr T. D. A. Cockerell, and it will prove of great value to the student of the coccids, as it contains not only full descriptions and figures of *A. perniciosus* and the species nearly related to it, but a geographical list of all the described species of *Aspidiotus*, with a short summary of their characters.

Care of the Brood in Holothurians

Prof. Hubert Ludwig of Bonn writes to the *Zoologischer Anzeiger* to say that he is able to record an antarctic *Chirodota*, in which the care of the brood is well marked. The species is *Chirodota contorta*, was described in 1874, and forms an abundant part of the material obtained by the Hamburg-Magellan Collecting Expedition. Prof. Ludwig says that in this species he has discovered a form of care of the brood previously unknown among echinoderms. In the female (the sexes are separate in the species) the genital canals themselves become receptacles for the brood, and the entire development is passed through within them. The young at 3 mm. in length are born through the genital aperture; they have then seven tentacles, and the 'wheels' and 'hooks' are already well developed. Further details of this discovery of Prof. Ludwig's will appear in his forthcoming memoir on Antarctic Holothuria.

Solifugae

When revising a genus or describing a whole series of new genera and species, the average describer looks upon all details of habit or economy as beneath his notice. Not so Mr R. I. Pocock, who frequently appends to his papers notes as interesting to the general reader as important to the cabinet naturalist. In the September number of the *Annals and Magazine of Natural History* Mr Pocock deals with the group Solifugae, which contains arachnida of the genera *Galeodes*, *Solpuga*, etc., coming from tropical Africa. After a revision of the family and a description of the genera and species we find a note on the sound produced by a Natal species of *Solpuga*.

Mr G. H. K. Marshall, the observer, seems inclined to attribute the sound produced to "trituration of the creature's powerful jaws against the hard ground in which they seem to prefer to dig their holes, the operation being performed with the jaws, and the sound ceasing when the spider stops digging." Although Mr Marshall kept them alive he failed to detect any stridulation, though they made a considerable noise by energetically biting at the sides of the boxes, one of them nearly succeeding in escaping by gnawing its way through at one spot. A further note is to the effect that the Solfugae succumb more rapidly to the cyanide bottle than the ordinary spiders or scorpions; and Mr Pocock, in quoting Mrs Monteiro, to the effect that a large black scorpion was confined eight hours in a strong poison bottle before it succumbed, states that this is no doubt due to the fact of the richer development of the respiratory system in Solpuga. A further note of Mr Marshall's corroborates Hutton's observation as to the use of the terminal organ on the palpus. This is a gelatinous fan-shaped sucker with which the animal has the power of picking up objects, probably prey, and conveying them to its mandibles. The principal food of the Solpugae, according to Mr Marshall, are termites, "a small species which makes no mound, but builds mud tunnels along the surface of the ground among dead leaves, sticks, etc. When the Solpuga comes across such tunnelling it examines along it carefully, then suddenly breaks through the mud and extracts a termite, the presence of which it detects, I suppose, by either hearing or touch."

The evidence as to the poisonous nature of these animals varies. A Kaffir boy declared them very poisonous, sometimes fatally so, and a bite supposed to be from *S. darlingii* did not subside till the fourth day; on the other hand, Mr J. M. Hutchinson of Estcourt, Natal, finds the bite of *S. hostilis* "to be quite harmless, the forceps being unable to pierce the tenderest skin."

The British Pleistocene Mollusca

In 1890 a valuable summary of the Pleistocene (non-marine) mollusca of the London district was published in the *Proceedings* of the Geologists' Association by Mr B. B. Woodward. This paper treated the material from a geographical point of view, describing the geology of the localities where the shells were found, and concluded with a valuable table of distribution, in which were distinguished the living and extinct species. It was hoped that Mr Woodward would extend his researches into other districts, and we have now to welcome a second paper by Mr A. S. Kennard and himself, to which Mr W. M. Webb has contributed, on the Post-Pliocene (non-marine) mollusca of Essex (*Essex Naturalist*, x., pp. 87-109). This paper is treated

in practically the same way as the former, with the addition of a bibliography, and deals with that important series of shells obtained by the late John Brown of Stanway at Copford, as well as series from many other deposits. The mere mention of Grays, Ilford, and Clacton, as some of these other deposits, will show at once the special interest of the paper to London geologists and conchologists.

Among the more interesting notes given to us is the confirmation of the rarity of *Helix hortensis* in a fossil state; the absence of *H. pomatia;* the occurrence of *H. aspera* in the Lea Valley; the elimination of *Eulota fruticum* from the recorded fauna of Copford; the restriction of the distribution of *Pomatias elegans;* and the observation as to the increased size of *Helicella caperata* since Pleistocene times.

We have now a great advance in our knowledge of the geological history of the non-marine mollusca of our home district; and though some of the names in Messrs Kennard and Woodward's list may be a little startling to the uninitiated, we are glad to see a possible termination of the confused nomenclature which has prevailed for so many years.

Triassic Cephalopoda

The description of Triassic Cephalopods occupies an important part of the recently-issued volume of the *Denkschr. d. k. Akad. Wissensch., Wien.* Franz v. Hauer, who has been contributing to the literature of Triassic Cephalopods for more than thirty years, and although now considerably past his threescore years and ten, furnishes a paper on the Trias Cephalopods of Bosnia. This author has already described Triassic Cephalopods from this region, but he now records from a new locality both Nautiloids and Ammonoids, among the latter being the new genus *Bosnites.* Dr E. von Mojsisovics, so well known for his work on the Trias Cephalopods, contributes a very important paper on the Upper Triassic Cephalopod-fauna of the Himalaya. It is based not only upon the older collections made by Strachey, Stoliczka, and Griesbach, but also upon the rich collection obtained by Messrs Griesbach, Middlemiss, and Dr Diener during their expedition into the Central Himalaya in the year 1892. As was to be expected, many new species are described and not a few new genera are proposed. The author points out that there is a marked contrast between the Upper Triassic fauna of the Indian province and the homotaxial fauna of the Mediterranean province, but he believes there was a sea connection between the two regions during Upper Triassic times, and is of opinion that an examination of the intervening districts will probably render the provincial character of these two regions less apparent.

Lobster Fishery

Mr James Hornell has contributed two long letters to the *Jersey Times* and the *Jersey Evening Post* relative to the Lobster Fishery of the Channel Islands. There is a marked and general decrease in the size of the catches, and some arrangements are needful for regulating and preserving the supply. Mr Hornell is of the opinion that the geographical position of the Channel Islands precludes—in view of the powerful currents sweeping their coasts—any useful purpose being served by the hatching and liberation of fry, wherever fry are surface swimmers for any considerable length of time. He does not forget in his argument that the currents may reverse their direction at regular times, but urges the importance of a detailed and exact investigation of current action around the islands before costly means are undertaken for stocking purposes. And at the same time he casts doubts from his own observation on the accepted idea that the young lobster is a pelagic animal, because he has found that in some experiments he has made that while he lost most of the fry by the surface pipe of his aquarium, those of the age of three days seemed inclined to sink to the bottom and abandon a surface life. Again, Mr Hornell has never once taken lobster fry in his almost continuous towings with fine muslin nets on the south coast of Jersey, while the fry of crabs, prawns, and *Squilla* occur in countless thousands. His method for the improvement and protection of the Lobster Fishery would be to rigidly enforce the protection of the berried female and all lobsters under nine inches, rather than to commence a nursery, both costly and difficult to manage. At the same time, if experiment were to prove the non-pelagic nature of the fry, then culture and liberation might be useful, in addition to the protective regulations referred to above.

Pre-Cambrian (?) Radiolaria in Australia

Prof. Edgeworth David and Mr Walter Howchin announce in the *Proceedings* of the Linnean Society of New South Wales, pt. 4, 1896, the discovery of Radiolaria in rocks of supposed Pre-Cambrian age in the neighbourhood of Hallett's Cove, about fifteen miles S.S.W. from Adelaide. The fossils occur in a dark, greenish-grey silicious limestone, and in a fine-grained laminated grey clay-shale, but they are very obscure and badly preserved.

Although no other fossils have been found at Brighton and Crystal Brook in the rocks in which the Radiolaria occur, there is a rich and abundant fauna in the Cambrian series of the district; but

in a subsequent note to this paper the authors state that they have found a great number of *Archaeocyathinae* at Normanville in limestone, which "appears to be conformable to strata which most resemble those in which the radiolarian casts have been observed." Hence they are inclined to believe that the Radiolaria may be in Lower Cambrian or passage beds rather than Pre-Cambrian.

Freezing of Plants

Messrs Gustav Fischer, of Jena, have just issued, in book form (73 pages 8vo), an account of some researches by Prof. Hans Molisch on the freezing of plants. The author, by means of an arrangement which he describes in the first chapter, has observed under the microscope the changes which occur in freezing not only in plant-cells and tissues, but also in colloidal substances, emulsions, coloured liquids, and salt-solutions. For observation the microscope is placed in a triple box. The outer case is of wood, then comes a hollow-walled zinc chamber, inside which is fitted the instrument, the tube projecting through the top. Sawdust is placed between the outer wall and the zinc chamber, and the hollow walls of the latter contain the freezing mixture. A wide zinc tube allows light to pass from the outside to the reflector. Several figures are given, showing the appearance of non-living substances as freezing. In all cases particles of ice are formed by separation of the water, while the gum, particles of latex or concentrated salt-solution occupy the intervening spaces. Three figures (p. 17) of an amoeba, alive, frozen, and thawed respectively, are of interest. In the frozen state the organism forms a lump of ice intersected with a highly complicated network, consisting of protoplasm very poor in water, concentrated cell-sap and air-bubbles. When thawed there is a much less sharply defined reticulum of dead protoplasm, the lacunae in which are the spaces which in the frozen state were filled with ice. *Spirogyra* cells (p. 22, fig. 10) in freezing lose about half their diameter by withdrawal of water, which then freezes on the outside; on thawing the cells swell to their original size, but protoplasm, chlorophyll band and nucleus form a disorganised central axis between which and the walls is contained the water.

After experimenting for five winters with hundreds of objects, the author comes to the conclusion that, as a rule, it is immaterial to the preservation of the life of the object whether thawing is rapid or slow, and that death by freezing is the result of an excessive loss of water, through ice formation, if the protoplasm by which its structure ("architektur") is destroyed, and that all the facts of the case can be easily and naturally explained from this point of view.

Funafuti

The third part of the Memoir of the Australian Museum on the Atoll of Funafuti contains further interesting additions to knowledge of the zoology of that island. Mr E. R. Waite has described the collection of mammals, reptiles and fishes made by Mr Hedley. The most interesting part of Mr Waite's memoir is an account of the habits of the fruit-eating Pacific rat, for which, following Thomas, he adopts Peale's name of *Inus exulans*. An interesting fact is recorded in reference to the edibility of fishes: at the time the expedition was on Funafuti the natives would only eat fish caught in the lagoon, all those from the reefs being condemned. The native explanation is that the pumice which was then being washed on to the beach rendered the fish poisonous; but as the pumice is harmless, Mr Hedley concludes that some marine organism arrived with it which rendered the fish unwholesome. Mr Waite quotes a remark of Wyatt Gills that good food fish become poisonous by eating the worms of the genus *Nereis*. The two species of Enteropneusta collected are described by Mr J. P. Hill; one of the two is a new species (*Ptychodera hedleyi*). Mr Whitelegge's account of the Alcyonaria includes a description of four new species and a redescription of several previously very imperfectly known. We regret to find that some remarks concerning the publication of this Memoir, made in reference to Part II. (*Natural Science*, July 1897, Vol. xi., p. 5) were based on a misunderstanding.

The Great Indian Earthquake

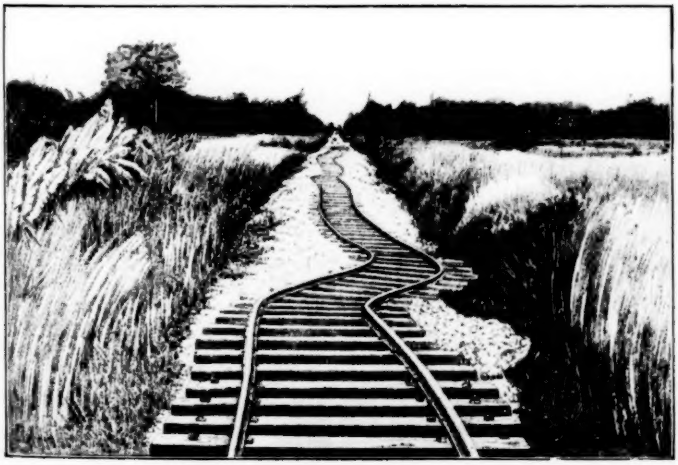
At five o'clock in the afternoon of June 12, 1897, Calcutta and north-eastern India were startled by an earthquake which is regarded as having exceeded even the famous Lisbon earthquake in the area affected. The Geological Survey of India immediately set to work to collect the data for a complete investigation. An immense amount of information has already been obtained, which it will take considerable time to digest. Sufficient has, however, been done to enable Mr R. D. Oldham to contribute a preliminary note to the Records of the Geological Survey. The area affected by the shock included more than a million and a quarter square miles, while its effects appear to have been felt even in Edinburgh and Rome. The shock was most destructive in Assam: at Shillong in the Khasi Hills it is said that hardly one stone has been left standing on another. Heaps of road metal have been scattered into layers a few inches deep. All masonry has been shattered into pieces, so that the roofs fell bodily down on to heaps of ruins. A cylinder seismometer had fortunately been

erected at Shillong in 1882, and this was thrown to the north-east: it enables the velocity of the wave to be calculated. The range of motion is estimated at 7·4 inches. So Mr Oldham concludes that "the violence of the shock at Shillong was at least equal to a backward and forward shake of 7 inches repeated sixty times a minute." All telegraphic communication was of course destroyed, and the accompanying illustration (reproduced from a plate of the Indian Survey Records) shows the effect on the railway lines produced by the movement of the surface soil. The rate of transmission of the shock was over 100 miles a minute. The fuller account promised will be awaited with much interest, for it will probably yield suggestive information as to whether the Himalayan movements are still in progress. It is fortunate that the work will be carried on under the supervision of Mr Oldham, who is keenly interested in all the broader problems connected with seismic movements.

Geology in New South Wales

The most noteworthy point in the recently issued Report of the Geological Survey of New South Wales is the discovery of Devonian plant remains and Lower Silurian graptolites by Mr Joseph Carne. This is the first identification of Lower Silurian Rocks in the Colony, and they are of special interest in that they contain in the neighbouring Colony of Victoria the famous saddle reefs of Bendigo. The graptolites were found in a black slate in the Parish of Lawson, Wellesley Co., and occur as shiny films. Mr W. S. Dun identifies them as *Didymograptus furcatus* (Hall), *D. extensus* (Hall), *Dicranograptus*, *Diplograptus*, and *Phyllograptus*. The Devonian plants comprise a Pecopterid fern and a *Sphenopteris*. They came from Genoa River, Co. Auckland.

BRIDGE ACROSS NALLAH AT HALDIBARI



LINE BETWEEN HALDIBARI AND MOGHAL HAT

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I

The Fundamental Principles of Heredity

IN the recent elaboration of the Theory of Descent, as first fully published by Charles Darwin, two schools of thought have arisen. The one, though professing discipleship pure and simple, has laid extreme stress on the principle of Natural Selection, which owes so much to Darwin, but has rejected his belief in the internal tendencies of races to vary in adaptation to changed surroundings; while the other has attributed the greater share in the transformation of species to the latter factor, and sent Natural Selection in the background. The two most illustrious leaders of scientific thought have been August Weismann on the one side and Herbert Spencer on the other. Their debates have long since obtained an audience among the cultured laity; but while the arguments are well known, some of the most important facts have been rather taken for granted than fully stated and clearly co-ordinated even in the scientific press. I allude especially to the coarser relations of the actual mechanism of reproduction and of the act of transmission from one generation to the next of the form which clothes on or assumes the parental characters. Such an exposition as we have to make cannot be limited to the higher organisms which are familiar to us in our daily life, for these are complex elaborations; while the primitive types, though still existing abundantly, are only to be studied with the microscope. It is in this field, hidden if not buried, that we must first labour, if we wish to rightly understand the foundations of the wonderful superstructure of the higher Organic Kingdoms. We shall endeavour to use as few unfamiliar terms as possible, bearing in mind that the reader has no Handy Atlas to help him in following the exploration of this foreign country, with its outlandish names.

Only two centuries ago the microscope revealed to mankind an immense world of minute living creatures as well as the details of the structure of the familiar Animal and Plants. Naturally enough the early observers, or 'philosophers,' as they were then called, inferred that these strange small creatures must have as complex a structure as our own. They proceeded zealously to search for, and sometimes to proclaim, the existence therein of brain, heart, blood-vessels, etc., just like those of ordinary bird, beast, or

fish.[1] Since then we have learned that the ultimate units of structure of the familiar organisms are identical in character with the entire organism of one of such microscopic being; and the search we have referred to would be now regarded as equivalent to seeking in a limestone pebble the pillars and buttresses, the vaults and domes of a great cathedral in miniature. Such units of structure are called 'cells,' an ill-chosen term indeed, whose signification, however, as a nucleated unit of protoplasm, is familiar to everyone. The lower organisms consist of single cells or of aggregates of similar cells; the higher ones consist of complicated arrangements of those dissimilar aggregates of cells which we call tissues. The former we call Protists, distinguishing between Protozoa and Protophytes according as the mode of existence is animal or plant-like; the higher animals and plants we term Metazoa and Metaphytes respectively, the appropriate conjoint term, 'Metists,' not having been coined by any recognised authority.

Throughout the higher groups the act of reproduction[2] of the race consists in the separation from the complex organism of single reproductive cells, which may either independently grow up into the original form, or else one with another fuse to produce a new cell which grows up. Again in most Plants and many Animals multicellular portions of the body may become detached, and finally develop into complete organisms; this we shall call 'propagation,' not 'reproduction.' In either case the parent body continues to exist, alive or dead, after the detachment of these cells or groups of cells. In Protists, matters are very different; for here, when the cell individual has attained its full size, it usually divides into two new cells, and itself is no more, alive or dead. We call the original cell a 'mother cell,' the new ones 'daughter-cells,' by a convenient metaphor; but we must remember that the devoted mother here absolutely merges her very existence into that of her offspring, a self-denying type of maternity often imagined but never realised among ourselves. Thus as Weismann first explicitly stated, the Protists may escape personal death by the sacrifice of their individual life; he therefore terms them 'immortal.' It is with cellular pedigree, according to the mode of parentage we have just explained, that we shall mostly have to deal in this paper.

The modes of reproduction among Protists are many and various.

[1] Thus Baker writes in the middle of the last century: "Search we further and examine the Animalcules—many Sorts whereof it would be impossible for an human Eye unassisted to discern; those breathing Atoms, so small they are almost all Workmanship! in them too we shall discover the same Organs of Body, Multiplicity of Parts, Variety of Motions, Diversity of Figures, and Particular Ways of Living as in the larger Animals.—How amazingly curious must the Internal Structure of these Creatures be! The Heart, the Stomach, the Entrails and the Brain. How minute and fine the Bones, Joints, Muscles and Tendons! How exquisitely delicate beyond all Conception the Arteries, Veins and Nerves!" ("The Microscope Made Easy," by Henry Baker, ed. v., 1767.)

[2] In the limited sense, distinguished from 'propagation,' as defined immediately.

The most familiar is the simple halving of the cell each time it has attained double its original bulk (Herbert Spencer's 'limit of growth'), a process termed in Hibernian phrase 'multiplication by simple division.' Sometimes, however, the first division is followed immediately by another, and so on, so as to produce with little delay grandchildren or great-grandchildren, &c.; this process is called 'brood-division,' or, when the progeny do not immediately separate, 'segmentation.' Again the progeny of brood-divisions may assemble in groups, usually in pairs, which fuse to form a new or 'coupled-cell'; this process is called 'conjugation,' or, if the 'pairing-cells' are dissimilar, 'fertilisation.' We must bear in mind that conjugation processes are not, strictly speaking, processes of multiplication; for the act of pairing halves the total number of cells for the time being, one replacing two: the two literally become one flesh.

We very often find these three reproductive processes recurring in cycles, *e.g.*, a succession of simple divisions at the limit of growth is wound up by brood-formation, and the brood-cells conjugate; the coupled-cell then initiates a fresh cycle. But the order of the processes varies in different cases, and sometimes even different modes of brood division may alternate. Thus a common Gregarine, parasitic in the Earthworm, shows the following: after conjugation the coupled-cell undergoes repeated brood divisions so as to form many hundred of brood cells; each of these matures into an oat-shaped body surrounded by a hard shell. After a time the oat-shaped cell divides again by brood formation into eight sickle-shaped cells, which finally leave the oat-shaped case and migrate into the living cells of the worm.

In many cases the separation of the daughter- or brood-cells is not complete, and they remain associated in more or less close union. Such an assemblage of cells of common origin is called a biological 'colony' in the strict sense, the term 'social aggregate' being used for an assemblage formed like a human colony by the flocking together of originally isolated organisms. Protist colonies may be formed in three ways, the third being only a combination of the first two:

(1) Cell division, alternating with intervals of growth, gives rise to daughter-cells which remain united together.

(2) Brood division (segmentation) produces a number of cells which remain united together.

(3) A colony first formed by segmentation continues to enlarge by the division after growth of its several cells, the daughter-cells still remaining connected.

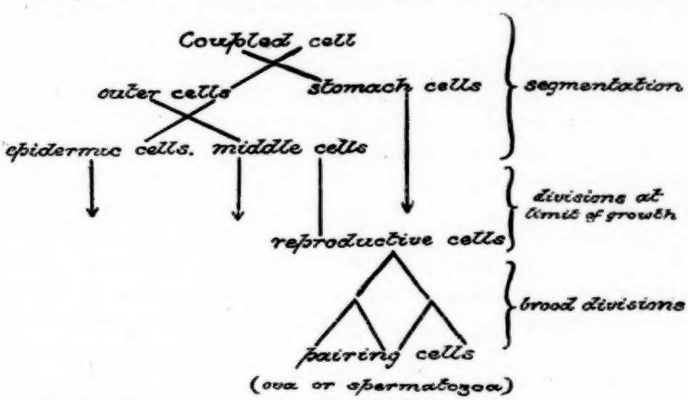
Colonies of the first and third type may be propagated by the separation of a part of the colony; if the separated part consist of a single cell this merges into true reproduction.

In the most primitive colonial Protist, all the cells of a colony are practically alike; and the colony ultimately breaks up into its individual cells, which reproduce in one or other of the ways described above. But in some cases the colonial habit has induced differentiation among the cells. There is a striking example of this in *Protospongia haeckelii* (a small organism found in pond-water by Savile Kent), which consists of a large mass of cells united by a gelatinous secretion. Those at the outside of the mass are provided with a waving lash, the base of which is surrounded by a funnel or collar of protoplasm. These cells take in the food particles brought into contact with them by the waving of the lashes in the surrounding water; while the cells at the centre of the colony appear to be only indirectly nourished by the food, which is digested and transmitted to them from the collared-cells. Our knowledge of the life-cycle of the organism is still very incomplete, but it appears certain that only the central-cells can truly act as reproductive cells by segmentation, while outer-cells may possibly separate to propagate the race also by the slower process of nutrition and growth, followed at intervals by simple division. We might almost regard this as a Metazoon with two tissues—the outer one nutritive, the inner reproductive, and ascribe the specialisation to the relative position of the two layers: the outer one is favourably situated for obtaining food from the ambient water; while the inner, debarred from all activity by its position, and fed and sheltered from the stress of contact with the unkind world by the outer layer, devotes its energies to the reproduction of the species.

Indeed, this organism, as its name implies, is, as it were, a forerunner of the Sponges, and probably represents a last survivor of their ancestral type. For a simple Sponge is a sack attached by the bottom and widely open above, with the wall pierced by numerous pores. This wall consists of three layers, an outer epidermic layer, an intermediate layer, and an inner or stomach layer, the cells of the last possessing lash and collar. The lashes of the stomach-cells produce a constant current of sea water through the sack, which passes in through the pores and out through the mouth, and brings with it the food particles which the stomach-cells alone can take up, the two other layers being nourished by them. In this case it seems that only such fragments of the Sponge as contain all three layers can propagate it; and in nature, indeed, hollow outgrowths of the sack are formed as branches, and may even be detached as buds. But only the intermediate layer, sheltered as it is on every side, differentiates certain cells as reproductive-cells. These by brood divisions produce male and female pairing-cells; and the coupled-cell after fertilisation grows up into a fresh Sponge. We have here a very marked advance on the primitive colonial

Protists; for here the colonial organism can only be propagated by the co-operation of all three kinds of cells. The individual cell is no longer a Jack-of-all-trades, but it has been so specialised that it needs the association and co-operation of cells specialised in other directions to form a complete self-sufficing organism; and each kind of cell can by growth and division only reproduce its own type and tissue; but not the complete organism of which it formed a part. This has been aptly termed by Orpen Bower a process of sterilisation.

We have noted the richer endowment of certain of the intermediate-cells. We must now follow up the fate of the coupled-cell (fertilised egg, oosperm). This divides afresh repeatedly, and by its segmentation gives rise to a hollow spherical colony, one hemisphere being composed of smooth cells, while the other is provided with lashes. The latter now sinks into the former so as to give the colony the form of a lined skull-cap. The lining is composed



of collared-cells, which are the stomach-cells; the outer layer of cells again divides into two layers, the epidermic and middle cells respectively. This is essentially the processes of reproduction and early embryonic found growth in all Higher Animals, save that the middle layer may be formed from the inturned cells instead of, or as well as, the outer ones, and that the reproductive cells may be formed in different layers in different classes. The annexed genealogical table, starting with the coupled-cell and ending with the pairing or sexual cells, represents the cellular pedigree in a Sponge.[1]

From the above it is clear that the coupled-cells, though they are descended from middle-cells only, yet produce by their divisions offspring that ultimately become cells of kinds which are different, and have never been in the line of their direct descent. We might compare this with a race of which the older and the younger

[1] In this and the tables to follow we use the signs X to indicate segmentation, ʌ ʌ to indicate brood divisions, and || to indicate divisions alternating with growth.

members of a family were always sterile and different in character and endowments from the intermediate, fertile children, but where every fertile couple produced among its progeny some resembling the parents, others with the endowments and characters of the sterile uncles and aunts;[1] we must, however, bear in mind that any comparison of a strict cellular pedigree with the genealogical table of the members of a Metazoan race is only an analogy.

While the main features of reproduction in the Higher Animals run on the same general lines as the Sponges, certain of them may present differences; and especially, as above noted, the relation of the middle and the reproductive cells to those of the two original germ layers respectively, varies in different groups.

Propagation by budding in the higher animals, and regeneration, or the repair of injuries, are essentially two different aspects of the same phenomenon. In both cases the cells of one or more tissues multiply rapidly, and revert more or less closely to the state they possessed in the developing embryo. In some cases these 'embryonic cells' can only give rise to tissues like those they respectively sprung from, or, at least, to tissues belonging to the same layer; but in the lowest Worms the middle-cells are capable of thus forming other layers. In the Vertebrata the regenerative functions are strictly limited; thus, if the surface of the skin is completely removed over an ulcer or burn, the new epidermis only grows over by gradual extension of the living epidermis at the edges, not by its direct growth upon the raw. This is the rationale of the modern practice of 'skin grafts,' which implanted at intervals over the surface of a healing wound give so many centres for the new overgrowth of epidermis to start from, thus accelerating the process of 'skinning over.'

Most tissues of the Higher Animals retain sufficient 'vitality' to be able to enter at once on processes of regeneration of their own individual kind in cases of wounds; and in the Newts, for instance, even a complete structure like a limb or an eye can be renewed after amputation. The epiderm of Vertebrates retains in its deepest layer an almost indefinite power of growth and reproduction, the cells next the true skin forming a continuous stratum, each cell of which is constantly growing and dividing, the upper cell at each division becoming horny, to be ultimately cast off as other horny cells are formed beneath it, while the lower retains the original power of growth and division. This layer is absolutely comparable to the layer of cells that forms cork in most green plants. The periosteum or layer of cells overlying the bone has similar but less active powers.

[1] The case we have suggested for comparison is actually found in social Insects with their 'sterile castes' in each generation.

Reviewing the facts, we find that

(i.) In Protista, each cell retains the power of reproducing in its offspring its own characters or those of a direct ancestral cell, which we may term the law of direct cellular transmission uninterrupted or alternating, according as only one or several alternating modes of cellular reproduction constitute the genetic cycle.

(ii.) In Metazoa, the power of reproducing a complete organism is confined to certain reproductive cells, which must beget in their progeny cells like those which are only related to them collaterally; this we call the law of collateral cellular transmission.

(iii.) The remaining cells of the Metazoan can seldom or never revert closely enough to a primitive type to produce all those other tissues of which they are collaterals, though their propagative power may be very great. This limitation of reproductive power we may call the law of specialised sterility.

(iv.) In most cases of animal budding or repair we find that the several tissues co-operate to produce a complete organism; this we call the law of co-operative propagation.

MARCUS HARTOG.

(*To be continued.*)

II

The Place of Isolation in Organic Evolution

ALTHOUGH most writers on evolution mention the subject of isolation, very few attach much importance to it, Professor Cope even considering it as a function of natural selection,[1] which is putting the cart before the horse. This neglect of isolation is probably due to the term 'selection' having been used in such a variety of ways and having been made to include almost every process in evolution, even the origination of variations. But such indiscriminate use of a word which has a very definite meaning is objectionable, for it confuses in our minds several totally different things. To me it seems self-evident that all the known factors of organic evolution should be arranged under two heads: (1) the origin of variations capable of being transmitted by amphimixis or by environment, or by use and disuse, or by any other means; and (2) the preservation of variations by isolation or segregation, as it has also been called. Possibly 'internal tendency,' 'kinetogenesis,' or 'action of the environment' may be other causes which tend to preserve variations, but they have not yet been clearly established as such, while there is strong evidence in favour of isolation being the chief, if not the only, cause of the preservation of variations. The subject of this paper is to point out the important part which isolation must play in evolution.

Professor Y. Delboeuf has shown[2] that if in any species a number of individuals, bearing a ratio not infinitely small to the entire number of births, are in every generation born with a particular variation, which is neither beneficial nor injurious, and if it is not counteracted by reversion, then the proportion of the new variation to the original form will increase until it approaches infinitely near to equality. Now the effect of the isolation of a few individuals is to largely increase the ratio of any new variation which may appear among them to the total number of births, and thus to largely increase the chances of its preservation. On the other hand, every variation which arises in a few individuals, and which is subject to the free intercrossing of a large number of other individuals, will tend to disappear. Intercrossing is probably favourable to the production of variations, although it is unfavour-

[1] "Primary Factors of Organic Evolution," p. 386.
[2] Quoted in Murphy's "Habit and Intelligence," p. 241.

able to preserving them; for while cross fertilisation (amphimixis) may stimulate variation, it also prevents the variations from progressing by their mutual interference, and thus it tends to keep a species constant, but ready to vary when circumstances require it to do so.[1] Self-fertilisation, on the other hand, may be unfavourable to the production of variations, but when one does appear it has a good chance of being established.

The general belief that breeding in-and-in is injurious has led to the conclusion that a large and healthy progeny cannot arise from a few parents if they are kept quite apart from all others. But that cross-fertilisation is not necessary for the rapid increase and continued health of the descendants from a few common ancestors is proved by the successful naturalisation of many animals in New Zealand from very limited stocks. The honey-bee was introduced by the Reverend Mr Cotton, chaplain to Bishop Selwyn, who procured a few hives from Sydney; and, in 1866, wild bees were common in the forests of the North Island. Seven Chinese pheasants were introduced in 1851, and six more in 1856—more than half being cocks; and pheasant shooting near Auckland commenced in 1865. A few black swans were introduced by Sir Walter Buller in 1864. A few cirl buntings were turned out near Dunedin about 1868. A very few silver-gray rabbits were released at Kaikoura; and, I believe, only three Tasmanian opossums were turned out in the forests of Southland; yet all these species are now abundant and healthy. The herd of deer in the Wairarapa (Wellington) has sprung from one stag and two hinds turned out in 1863; and the herds in other parts of New Zealand have all started from very few progenitors. Also many of the self-introduced insects—as the English lady-bird (*Coccinella undecimpunctata*), the drone-fly (*Eristalis tenax*), the horse-bot (*Gastrophilus equi*), and *Lucilia caesar*, could only have been introduced in small numbers, for each has spread from a single centre; but yet they have been very successful. It is true that several failures to naturalise animals could also be given, but these failures do not invalidate the evidence supplied by successful naturalisation, and it is evident that, when the surroundings are favourable, it is quite possible for a few individuals to give rise to a new and vigorous species which might in time become dominant.

Isolation must therefore be a true cause of the preservation of variations, and also it must be an important one. The artificial selection of animals and plants by man might just as well be called artificial isolation. The breeder, or the horticulturist, certainly selects the variation he wishes to preserve, but he also isolates it; and it is the isolation which causes the variation to be preserved—

[1] See Professor H. R. Orr's "Development and Heredity," p. 234.

selection only securing that the variation is a good one. The natural selection of Darwin works in the same way: that is, it isolates beneficial variations by killing off the others. It is not so much natural selection as natural elimination; for, as Professor Lloyd Morgan has pointed out,[1] it is not by the survival of the fittest, but by the elimination of the least fit, that new species are made. Isolation by elimination must always tend to preserve variations which are useful to the competing individuals, while isolation by other means may preserve not only useful, but also indifferent and even injurious, variations, as in the case of domesticated animals and cultivated plants.

Isolation by Selection—or natural selection in a restricted sense—implies an outside agency as selector for whose benefit the isolation is made. These cases of true natural selection are limited to selection by insects. Several kinds of beetles, domesticated by ants, have become blind, and some of them are unable to feed themselves. These variations are evidently injurious to the domesticated animals, but useful to the ants, as they prevent the beetles from running away. The sticky secretion of aphides must also be injurious, if we may judge by the eagerness with which they allow the ants to remove it; and we must, therefore, suppose it to be due to selection by the ants. But how the selection was made we do not know.

The structural growths which, in many flowers, necessitate the visits of special insects to fertilise them, are also probably due to natural selection in its narrow sense, for it is very doubtful whether they are useful to the plants. In the first place the plants which have the most elaborate apparatus for securing fertilisation by certain insects only are uniformly rare; while self-fertilising and anemophilous plants are abundant.[2] Secondly, very few annual plants, which must set seeds every year, have complicated flowers, and some of these—such as the annual peas and beans—are also self-fertilising. Thirdly, many perennial plants with elaborate flowers have resorted to other means to secure fertilisation in case insects fail to visit them. Fourthly, the great number and abundance of plants, whose inconspicuous gamopetalous flowers show that they have reverted from insect fertilisation, is a sufficient proof that they have not suffered any harm by doing so. We must therefore conclude that the elaborate flowers found in many of the so-called entomophilous plants are quite unnecessary for their well-being, and, indeed, must be sometimes harmful, for they render fertilisation

[1] "Animal Life and Intelligence," 2nd ed., p. 791.

[2] Henslow, "On the Self-Fertilisation of Plants," *Trans. Linn. Soc.*, 2nd series (Botany), vol. i., p. 317.

uncertain and irregular. There is still another reason for coming to the same conclusion. If it be good for a plant to have its flowers fertilised by pollen from other plants, then the grouping of flowers into a head or spike must be injurious, because it almost insures that the flowers shall be fertilised by pollen from other flowers of the same inflorescence, which Darwin says does little or no good; and yet plants with capitate flowers are numerous and prosperous.

That cross-fertilisation is useful is proved by the fact that all the higher animals are bisexual; but that it is not essential is also proved by the existence of large numbers of asexual organisms, and by the fact that the highest plants are hermaphrodite. The first phanerogams were, no doubt, diclinous and anemophilous. As the number of species increased the individuals of each species would diminish, and, consequently, fertilisation by the wind would become more uncertain; and, probably, it is for this reason that the higher angiosperms became hermaphrodite. But this hermaphroditism was tempered by dichogamy, the origin of which is not connected with insect fertilisation. The visits of insects came later. They commenced to cultivate, as it were, the flowers for their own use, each species trying to preserve the honey for its exclusive benefit; for it is evident that all these floral arrangements—including colour, capitate flowers, scent, etc.—are very useful to the anthophilous insects, for whom the honey is preserved. But these flowers, elaborated by insects for their own benefit, have secured complete isolation for the plants to which they belong, and the variations have therefore been preserved, whether they were useful or indifferent, or even when they were injurious, as in the reduction of stigmatic surface in the orchids, the abortion of one half of each anther in *Salvia*, and the asexual condition of the ray-florets in some of the Compositae. All the changes, however, are useful to those insects which alone can fertilise the flowers, and Dr Hermann Müller thinks that different kinds of insects have evolved different kinds of flowers suited to their tastes. In fact, these flowers have been cultivated by moths and bees, just as ants have domesticated some beetles and aphides. The plants that have escaped from their cultivators have run wild again, like rabbits in Australia and New Zealand.

Isolation by Elimination—or natural selection in Darwin's sense—must always have a utilitarian cause, because the elimination is for the benefit of the remainder—that is, for the selected. It may be a struggle for food, or it may be a struggle for protection against enemies, or it may be a struggle to secure the persistence of the species; but in all cases it must be a struggle with death as the penalty for being vanquished, because, without elimination by death, there can be no selection and no isolation. It is only the struggle

for food which is brought about by the rapid increase of the members of a species; the struggle for protection and the struggle for perpetuating the species do not at all depend upon the doctrine of Malthus. On the contrary, the more individuals there are of a species, the less the necessity for securing special means of protection, and the less is the risk of the species dying out. But in all cases the power of natural selection increases as the structures which influence the struggle get more perfect and as competition gets keener. It can hardly come into play in the early stages of a variation, or where competition is checked by geographical isolation; but it has increased in importance with the age of the earth, and is now the dominant factor in the evolution of species among the higher animals and plants.

Geographical Isolation. The rapid increase of the individuals of a species not only leads to competition for food, and thus to isolation by elimination, but it also leads to emigration and change of habits, and thus to geographical isolation. This subject has been fully discussed, especially by Moritz Wagner,[1] the Reverend J. T. Gulick,[2] and Professor Romanes,[3] and I will merely give a new illustration of the principle. There are twelve different kinds of albatrosses belonging to three genera which roam over the Southern Ocean, most of them mixing freely together—nine or ten occurring in the Tasman Sea—but each having its own separate breeding-places, to which it retires every year. Now, as these birds have no enemies, and as their specific characteristics are not connected with the struggle for food, we cannot suppose that each species was formed by competition on the ocean, and that each subsequently chose a separate breeding-ground, or—in other words—that the development of their specific characters preceded their isolation. Evidently isolation preceded, and caused the preservation of, the variations, which in time became of specific importance. The three species of the North Pacific must also have originated in the same way. It should be noticed that these species are nearly, if not quite, as well characterised as those species which have been developed by natural selection; the intermediate varieties having died out, although there can have been no elimination by competition. And as all live under the same conditions, the variations can hardly be due to the action of the environment. Geographical isolation must often have been the means of preserving, not only indifferent characters, but also the incipient stages of useful ones, which have been subsequently developed by elimination.

[1] See Gulick in *Journ. Linn. Soc.* (Zool.), vol. xx., p. 193.
[2] *Journ. Linn. Soc.* (Zool.), vol. xi., p. 496, and vol. xx., p. 222.
[3] *Journ. Linn. Soc.* (Zool.), vol. xix., p. 348.

Physiological Isolation. This was first brought forward by Professor G. J. Romanes.[1] By it is meant those cases where the individuals of a species mix together during the breeding season, but, for some reason or other, certain individuals are restrained from having sexual intercourse with others. The simplest case is that of a sexual reproduction which insures that each individual is isolated from all others, and, consequently, any variations that may arise are preserved, unless counteracted by reversion. Probably this is the cause of the immense variety found among the Bacteria, Diatoms, Fungi, Radiolarians, and Foraminifera; and perhaps it is the reason why Bacteria are so readily modified when placed under new conditions by cultivation. Self-fertilisation is nearly as efficient; but a cross may occasionally occur. Ferns and many other plants, as well as many Coelenterates, are thus isolated and able to preserve indifferent variations.

Partial sterility with the parent form (the physiological selection of Professor Romanes); the selective association of Dr A. R. Wallace; and change in the season of flowering or of pairing, all appear to be true causes of physiological isolation. I have lately given an example of the process of species manufacture by the last process in the case of some petrels on the Kermadec Islands.[2] Two varieties of *Aestrelata neglecta*—the mutton-bird and winter mutton-bird of the settlers—breed on the same island, but at different times of the year. The first has the neck and breast, and sometimes the whole under surface, gray; while the winter mutton-bird has only a gray band on the breast, the rest of the under surface being white. Here physiological isolation is bringing about much the same result as geographical isolation has done in the case of the albatrosses, for —as with them—we must suppose that the change in the time of pairing preceded the change of plumage.

Sexual selection is better considered as a form of physiological isolation than of natural selection, for there is no elimination of the males; they are not killed off, but can, after defeat, try again to obtain a partner. Some males secure the females either by greater strength or by superior weapons of offence, or by superior means of capturing them, while others are selected or rejected by the females; and in the case of birds, the latter mode of selection seems to explain the preservation of many beautiful variations in plumage. Dr Wallace supposes that these beautiful variations in plumage have been produced by the greater vigour of certain males, which is probably true; but no amount of vigour in the male would, by itself, secure the preservation of these variations without isolation, and this has been due to sexual selection. It is possible that the females select the males for their vigour and not for their beauty,

[1] *Journ. Linn. Soc.* (Zool.), vol. xix., p. 350. [2] *Proc. Zool. Soc.*, 1893, p. 753.

although there is much evidence to the contrary; but, in either case, isolation by sexual selection is necessary for the preservation of any variations the males may possess.

From this examination of the place of isolation in organic evolution I conclude that species generally originate by the preservation of individual variations by means of geographical or physiological isolation, which may be brought about in many ways; and that, in most, but by no means all, cases they are improved and developed by competition and natural selection; and this competition they find only in large and well-populated areas.

F. W. Hutton.

III

The Relation of Acquired Modifications to Heredity

TO most evolutionists it must be evident that a distinct change is coming over the controversy on use-inheritance. Not only are the views expressed less positive, but there also seems some likelihood of a compromise. A letter to *Nature*, last April, by Professor Baldwin, was, I think, expressive of the feelings of evolutionists generally.

Bateson has remarked[1] that "The study of variation thus offers a means whereby we may hope to see the process of evolution." This position does not seem to have received the attention which, I think, it deserves; and it is with the hope of helping to turn attention to these points that I offer two suggestions on this subject.

Ever since Galton put forward his "Theory of Heredity," the problem of use-inheritance has been coming more and more to the front, and became almost the main point at issue after the publication of Weismann's Essays; so that we have now the curious anomaly of evolutionists of the highest eminence occupying all grades between the extremes of Professor Henslow, who denies the action of natural selection altogether in the formation of species, and Professor Weismann, who nearly as emphatically denies the action of use-inheritance.

This is the more extraordinary when it is remembered that the intermediate position, occupied by Romanes and Lloyd Morgan, has practically disappeared, owing to the death of Romanes and the secession of Lloyd Morgan to the Neo-Darwinian position.

The difficult if not impossible task of finding any really satisfactory test case that is capable of only one explanation is no doubt largely responsible for the divergence of opinion. But I believe there is also another cause for this divergence, namely, that the vast field which the subject covers compels all but the most powerful minds to limit themselves to a portion only of the subject. It will be seen on reflection that most of the Lamarckians have mainly studied either the lower forms of life generally, have been more or less exclusive botanists or palaeontologists, or have devoted their attention to less important structures or easily variable species; while on the other hand the Neo-Darwinians have studied large living groups of animals or the more

[1] "Materials for the Study of Variation."

highly-developed and more differentiated organisms in animal or vegetable kingdoms. While such men as Darwin and, to a less extent, Romanes have occupied a more general position, the numerous almost unconscious impressions that come to an investigator in any branch of science, the little details of practical experience which are rarely if at all jotted down, even by the most painstaking recorder, give, I believe, a general and correct, though usually unconscious, colouring to all his work, original or otherwise, and are largely influential in determining his convictions.

It is to this colouring from different surroundings that I attribute the positions taken up by the various evolutionists, and I think, had it been possible for the Neo-Lamarckians and Neo-Darwinians to have exchanged positions at the commencement of their scientific studies, that both sets of investigators would have materially altered their opinions.

The conclusions drawn, both on theoretical and practical grounds, from the study of the principal works of both sides, seem to me to support the following propositions:—

(1) That the simpler the organism, the greater the power of use-inheritance.

(2) That the higher stages of evolution entail increased differentiation, and therefore increased difficulty of direct adaptation to environment, and therefore increased dependence on natural selection.

(3) That high specialisation must be accompanied by a correspondingly increased stability, and, therefore, increased difficulties in the action of use-inheritance, on account of the increased dependence of those specialised parts on each other.

(4) Lastly that, with the increase of natural selection, the variations must become increasingly adaptive.

The second point has special reference to the theories of heredity. To anyone who considers for a moment the immense importance assigned to automatic, unconscious, and reflex actions in Psychology, Physiology, and Pathology, and the large amount which has been written on habit and its effect on the organism, it must seem remarkable that so little importance has been given to it in evolution and heredity. Erasmus Darwin considered that as the embryo was made up of two portions which had formerly belonged to its parents, it was reasonable to suppose that it would to a large extent retain the habits of those parents.

More lately, Professor Ewald Hering has extended this idea to what he aptly defines as unconscious memory. His explanation of heredity lies between the physiological and morphological schools.

He supposes first that under appropriate circumstances a small amount of the original substance may be capable of governing the course of the future organism, just as the mathematician may construct from a small portion of a curve its whole extent. And, secondly,—

"If in a parental organism, by long habit or constant practice, something grows to be second nature, so as to permeate, be it ever so feebly, its germinal cells, and if the germinal cells commence an independent life, they will aggrandise and grow till they form a new being, but their single parts still remain the substance of the parental being."

The objections to this theory lie, I think, in the fact that direct communication with the reproductive organs becomes with increasing specialisation increasingly difficult, and therefore heredity and reproduction would cease when a certain point in the specialisation was reached.

Nevertheless, some kind of provisional theory such as the following would, I believe, explain better than any other theory most of the phenomena of inheritance:—

(1) That in every cell there are certain reproductive units which are necessary to the development of that particular cell.

(2) That these reproductive units having a very complicated structure (being composed of specialised protoplasm), are capable of modification when acted on by external forces.

(3) That the various impressions made upon the cell would of necessity be made upon these units also, and that this impression will be proportional to the length of time and intensity of the impression made.

(4) That as specialisation of tissue occurs, each reproductive unit will tend to reproduce its own history, past impressions becoming with each successive addition more and more blurred.

(5) That the stronger and more numerous the past impressions, the more difficult will it become for present impressions to affect them, hence progressively diminished power of use-inheritance.

(6) That the reproductive units have the power of self multiplication when in the latent condition, and that this multiplication will be difficult in proportion to their specialisation and complexity. Hence latent germs would tend to be carried on from one generation to another, and increase the general stability of the organism.

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(7) That when not required in cell development they will tend to pass into the system of the organism, and that when suitable conditions arise they will tend to reproduce the cells from which they are derived.

In the earlier forms of life these units will diffuse themselves throughout the organism (Protozoa), but as differentiation occurs these units will tend to become localised at one or more places (Hydrozoa). Of these places one will become more important either from habit or position, and this will become fixed and subsequently specialised (ovary or testis). The cell differentiation will at last become so great that it will stop all reproduction of parts except at the specialised centre. Partial renewal of limbs, etc., in the earlier vertebrates becoming rarer and ceasing altogether as we ascend to the higher vertebrates.

(8) That these reproductive units having once started a phenomenon in any given direction, the direction will tend to be kept up and continued by physiological laws.

(9) That each unit would tend from habit to occupy in a new organism a position similar to that which it occupied in the parent.

This theory would explain the constancy of type, as there would be a continually increasing balance in favour of heredity. It would satisfactorily explain the recapitulation theory of embryology. It would account for the recognised antagonism existing in both plants and animals between the reproductive and bodily growth, and it would afford an explanation of growth in abnormal situations.

In conclusion, I think it will be found that we are brought back to a closer study of the causes of variations as the only satisfactory means of solving the fundamental problem of use-inheritance.

J. Lionel Tayler.

IV

A Carcinological Campaign

DURING the last few months there has been remarkable activity in discussing and describing new and peculiar forms of the smaller crustacea.

At Liverpool last autumn Mr A. O. Walker (15) announced his new Cumacean genus *Leuconopsis*, in which the male has on the second joint of the third foot a pair of curved blade-like processes, the feature unique, the function not yet explained.

In the *Transactions* of the Royal Irish Academy, Mr W. T. Calman (3) has enriched the caridea or true shrimps with a new family, Bresiliidae, established for a specimen taken at a depth of 750 fathoms off the south-west coast of Ireland. In the *Transactions* of the Royal Society of Edinburgh, Mr Calman (2) has re-described and re-figured the *Anaspides Tasmaniae* of G. M. Thomson, with a view of discussing the systematic position of this extremely interesting crustacean. It is found in Tasmania in pools at an elevation of 4000 feet. It is in structure at present quite unique. This combination of uncommon form with uncommon habitat led its learned discoverer to say that "owing to long isolation it has undergone very profound modification." But it may equally well be supposed that its isolation has enabled it to retain characters which in other crustaceans have been profoundly modified. Reasons are given by Mr Thomson for the opinion that the ancestral forms of *Anaspides* found their way from the sea into the streams and lakes of Tasmania as far back as Mesozoic times. Its thoracic limbs being divided into walking and swimming branches, it has reasonably been grouped with the Schizopoda or "cleft-foot" shrimps, and in some respects it seems to come nearest the Euphausid family, so distinguished for luminous organs. To such organs I fancied that the minute group of 'ocelli' on the back of the head, which Mr Calman has pointed out, might perhaps belong, but the guess has found no favour, although visual ocelli can scarcely be needed to supplement the stalked eyes. In the segments of the trunk the animal is rather like an amphipod, which it also resembles in having simple branchial vesicles. But these are in pairs. Mr Calman speaks of this latter circumstance as without parallel in adult malacostraca, overlooking, it would seem, the

'accessory branchiae' in certain amphipoda to which the late Professor Wrześniowski first called attention. In appearance *Anaspides* not only has seven thoracic segments distinct as in the Amphipoda, but also a segment immediately in front of these distinct. Here, however, Mr Calman maintains that the appearance is delusive, and that we have only to do with the well-known cervical groove of the carapace. He may be right. He may be wrong. The suggestion is certainly very ingenious. It would be inconvenient here to follow him into the details of so technical a question, or through the important comparison which he institutes between *Anaspides* and the palaeozoic crustacea, *Palaeocaris*, *Gampsonyx*, and *Acanthotelson*. To all seeming, however, *Acanthotelson* is much nearer to the isopod genus *Apseudes* than to a schizopod, and the figures of Packard's restoration would have been better omitted, since they do not agree either with the original figures of the fossils or with the description given in the text. Meek's figures (*Geological Survey of Illinois*, vol. III., p. 549, etc., 1868) probably give all the information that can be depended upon.

Professor G. O. Sars (12) is bringing out in rapid succession the parts of his Isopoda of Norway, always with the fulness of satisfying illustration and exact description for which his work is celebrated, throwing a flood of light upon groups, such, for example, as the minute species of *Munna*, which before were puzzling and obscure. In his account of the Anthuridae he does not notice, and has perhaps forgotten, the view taken by Dohrn and Gerstaecker, and later brought into prominence by Dr Charles Chilton (3), that in this family the longer branch of the tail-feet or uropods is not the inner branch, as authors have generally supposed, but in accordance rather with homology than appearance, the outer branch. Dr Chilton also doubts whether this longer branch is ever really two-jointed, though it is open to maintain that it is sometimes actually and always virtually so. These are points on which the Norwegian professor's expressly declared opinion would be of much value. For the correct name of the very common Isopod, generally known as *Idotea tricuspidata* Desmarest, Professor Sars selects '*Idothea baltica* (Pallas).' As the synonymy of this species was exhaustively investigated by Harger in 1878, by Miers in 1881, and by Dollfus in 1895, it is amusing to note that, in the name finally adopted by each, they all differ from Sars and each one from the other. Harger was unable to consult Pallas' work. He therefore acknowledges that Meinert (1877) may have rightly regarded *Oniscus balthicus* Pallas as the earliest name of the species. The generic name *Idotea* came into the world with one letter missing, and this same much victimised letter is found as a superfluity in the specific name *balthicus*, so that *Idotea balthica* (Pallas) will be the form upheld by those of

us who think the spelling used by our scientific forefathers worth preserving.

For number of remarkable novelties the palm is carried off by M. Jules Bonnier. He describes (1) six new genera and forty-five new species of sessile-eyed crustaceans, obtained by Prof. Koehler on board the "Caudan" in the Bay of Biscay. The depths ranged from 200 to 1700 metres. Out of 52 species taken 39 proved to be totally blind. The new Cumacean genus *Procampylaspis*, like Mr Walker's *Leuconopsis*, displays an unexpected character, the 'finger' or terminal joint of the second maxillipeds being cut into strong unequal teeth, giving the appendage what might almost be called an unnatural appearance. The rapid movement of modern science is exemplified in the circumstance that M. Bonnier's new anthurid, *Calathura affinis*, is scarcely published before it has to be transferred, as it evidently must be, to Sars' new genus *Leptanthura*. To the family Arcturidae M. Bonnier contributes a new species, *Astacilla Giardi*, which is remarkable not only for a quite abnormal appendage on the breast of the male, but also because the male is slenderly drawn out to a length thrice that of the female. The exiguity of the creature recalls the vermiform male of an anthurid discovered by Professor Haswell wriggling into serpula-tubes in Australia. Another of M. Bonnier's striking results is the discovery of a crustacean parasite upon a Cumacean species. But this novelty also has been already transferred to a new genus by Dr H. J. Hansen, who, in a work noticed elsewhere, has described no less than seven new species of such parasites.

Miss Mary J. Rathbun (8, 9) concerns herself only with the Brachyura, but, as in more than one of her recently described new species, the full-grown crab is less than the fifth of an inch in length, these species at least may be classed among the smaller crustaceans. On the other hand, M. Adrien Dollfus (6) speaks of a new woodlouse, *Porcellio eximius*, from the north of Africa, as "cette magnifique espèce." It has the outer branch of the uropods in the male half as long as the body, as though it were a kind of peacock among woodlice, proud of its tail. Possibly these prolonged appendages enable their owner to execute strategic movements to the rear with caution and tact.

Miss Harriet Richardson (10, 11) has this year described two new species of *Sphaeroma*, and given figures of one of them. The first is notable for its habitat, having been taken not from the sea but from a warm spring in New Mexico. The second is notable for its objectionable habits, having been found boring the piers on St John's river at Palatka, Florida. The mischievous little creature has powerful jaws, and in eight years reduced timber of 16 inches diameter to less than half that measurement.

In his Pelagic Entomostraca of the Caspian Sea, Sars (13) discusses eighteen species, of which thirteen are new. Six belong to the new genus *Cercopăgis*, meaning "sling-tail." Were these animals twelve feet long instead of a twelfth of an inch they would rank among the most striking objects in zoology. The eye is enormous. The thread-like caudal process is sometimes half an inch long, fully six times the length of the body. Near the end this lash is "bent in a peculiar sling-like manner, the opposite edges of the sling armed with a double row of recurved denticles." Furthermore, out of a kind of gastric sympathy, the intestinal tube forms also a sling-like flexure or loop. In the female the incubatory pouch rises abruptly from the back and inclines forward, this monstrous sack of young ones being sometimes as large as the body which supports it.

In the *Proceedings* of the Biological Society of Washington (vol. xi., pp. 153-167, June 9, 1897), Miss Rathbun gives 'A Revision of the Nomenclature of the Brachyura.' It appears to be thoroughly sound in principle, and is certainly based on wide and accurate knowledge. Only, in a few points of detail, one may be permitted to question the results arrived at, and to defend, for instance, the name *Carcinus* for the shore-crab, *Thelphusa* for the river-crab, *Macrocheira* for the giant-crab of Japan, since the reasons for displacing these familiar names seem to be at least not imperative. Owners of Herbst's *Naturgeschichte der Krabben und Krebse* and of Leach's *Malacostraca Podophthalma Britanniae,* will find in Miss Rathbun's paper exceedingly useful tables, establishing the dates of the numerous parts of those works, the publication of which extended in the one case over two-and-twenty years, and in the other over no less than sixty.

The excellent plan of printing the very day of publication on cover and title-page is followed in Miss Rathbun's paper. Therefore, for her new generic name *Ucides,* in place of Latreille's pre-occupied *Uca,* we know precisely that the date is June 9, 1897. But of Dr Ortmann's *Oedipleura,* also a new name for *Uca* of Latreille, we can say nothing positively. Some supplementary notes of correction at the end of his valuable Carcinologische Studien are dated "Princeton University, New Jersey, d. 29 Mai 1897." This date was probably written on the proof copy. The paper was printed and published in Jena. It is for the publishers to tell us the exact date of publication. Until they do an expectant world cannot know for certain which has the priority, *Ucides* or *Oedipleura.*

It should be understood that the above remarks touch only a small part of the papers mentioned, and also that they leave unnoticed contributions by many other well-known writers, highly worthy of attention, though the forms discussed may not happen to

be quite so eccentric as those to which allusion has here been made.

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VI

South America as the Source of the Tertiary Mammalia[1]

OF the Argentine Territory during the Archaean era there only existed the frame of the massive mountains of the north-west and a few points and islets, which to-day form part of the various isolated mountain chains which rise from the plain of the Pampa, from Salta to Patagonia.

The oldest fossiliferous deposits of the first Palaeozoic epochs rest on these Archaean rocks: all the organisms are marine. In the latest times of the Palaeozoic era, during the Carboniferous and Permian periods, these small islands served as a nucleus for a greater extension of the land, and then great numbers of terrestrial organisms appeared, of a uniform aspect, precisely as the temperature in all parts of the globe was uniform.

The deposits of the greater part of the Mesozoic era, with rare exceptions, are found in the Cordillera, where they appear on either side in the form of narrow bands running north and south, proving that then as now the Cordillera of the Andes already existed as a long and narrow land which separated the Atlantic from the Pacific. Both oceans reached the foot of the Cordillera, but in the Atlantic the mountain chains of Tandíl, Ventana, Córdoba, San Luis, and various others formed large islands. At this time the geographical differences of temperature began to be felt, causing climatic zones, the most active of the factors which operate in the differentiation of organisms—a differentiation which allows us to determine the relations of the floras and faunas of different regions, and to restore the routes which they followed in their migrations across the lands of other times, which are not the same as those of to-day, furnishing us with the data to reconstruct the ancient connections of the lost continents.

We have now reached the latest time of the Cretaceous period, the most recent of those which constitute the Mesozoic era. Water predominated in the northern hemisphere, and land in the southern —the reverse of what happens at the present day. The European

[1] Translated by Mrs Smith Woodward from "La Argentina al través de las última épocas geológicas," an address delivered at the inauguration of the University of La Plata, April 18, 1897. (8vo., pp. 35. Buenos Aires: P. E. Coni & Sons, 1897.)

continent had not appeared, except as a few small islands. North America, completely separated from South America, formed a great island, with large lakes of brackish water; and this part of South America had lost its insular and peninsular form. The Argentine Territory had completely emerged, and extended to the east towards South Africa, while to the south and west it was prolonged to form a large continent, which placed it in connection with Australia and New Zealand.

It was during this epoch in that great southern continent, and especially in its central portion now constituting the Argentine Territory, that the highest organisms developed, the great class of the mammals which immediately spread over the southern lands, and subsequently penetrated by different routes into the northern hemisphere.

The great barrier of the Andes was then low, and did not hinder the atmospheric currents. The climate was hot and humid, and a luxuriant vegetation covered all the Argentine Territory. As far as the present Patagonian plains, to-day dry and sterile, there flourished large forests of palms and conifers, whose petrified remains fill whole deposits, in which one continually finds huge tree trunks transformed into flint still occupying their natural position and constituting dead forests, forests of stone, columns of flint such as that which one can see opposite the Museum of La Plata crowned with the bust of the unfortunate Crevaux, and which the imagination of the dwellers of the Patagonian deserts, on account of the undulation of the land, takes to be the masts of petrified ships.

Alternating with the branches and tree trunks transformed into stone, which fill the deposits of sandy rock appearing at various points of the Patagonian Territory, large bones are met with similarly petrified, belonging to terrestrial vertebrates of the extinct group Dinosauria. They were reptiles with an enormously thick tail, and the hind limbs much longer and thicker than the fore limbs, so that, supporting the body on the hind limbs and tail, they could assume a semi-vertical or oblique position resembling that of a kangaroo.[1] When one says that as a matter of fact they could have looked over the roofs of most of the buildings at La Plata, one can judge of the truly colossal size which some representatives of this group attained.

The birds of that time were no less noteworthy than the reptiles. They were such as *Physornis* and *Phororhacos*, true monsters, bipeds with short and thick wings, the claws of an eagle, and the beak of

[1] Of the three sub-orders into which the Dinosauria are divided, namely, Sauropoda, Theropoda, and Orthopoda, the characters mentioned above are peculiar to the two last. The sub-order of the Sauropoda, to which the gigantic genera of Patagonia, *Argyrosaurus* and *Titanosaurus* Lyd., belong, have the four limbs more or less equal, or the front pair scarcely any shorter than the hind pair.

a condor, of whose size we may form an idea from the head, which is much larger than that of a horse.[1] Being great runners, they gave chase to the mammals of that epoch, even to the most gigantic of them, and were doubtless not afraid to measure their strength with the Dinosaurs themselves.

But the animals of that period which in our formations offer special interest are the mammals. While in Europe and North America only some small representatives of that class lived, insignificant and little specialised, in Argentina they had attained an extraordinary development; they were large and small, of the most varied forms, showing that the Cretaceous deposits of our country contain the ancestors of almost all the groups of mammals which have succeeded each other one by one in different regions of the earth.

It would be a lengthy task to give you an account of the mammalian fauna of that time; it is only possible for me to outline the subject and to limit myself to noticing some forms related to others with which you are familiar.

That which first attracts the attention of the naturalist in this fauna is the presence of remains of the Primates or inferior quadrumana (*Notopithecidae*) of a greatly reduced size, which appear to be the ancestors of the extinct lemurs of Europe and North America, and of those existing in the South of Asia and Africa, while another branch leads to the *Homunculidae* (*Homunculus, Anthropops, Pitheculus,* etc.) of the Tertiary of our own country, which are the ancestors of the monkeys of both worlds, and consequently of man.

The carnivorous mammals were represented solely by a group to which I have given the name Sparassodonta, whose size varied from that of a 'laucha' (*Pharsophorus*) to that of the largest bear (*Proborhyaena*); they exhibit a mixture of the characters of placentals and marsupials, and represent the stock whence were derived the carnivorous marsupials of the Australian continent, the placental carnivores of both hemispheres, and a large number of the extinct forms of the northern hemisphere designated under the name of Creodonts.

Another most interesting group is that of the Plagiaulacoidea (*Polydolopidae, Abderitidae, Epanorthidae,* etc.), small marsupial mammals with a dentition of the type of the Australian kangaroos, but with the limbs more nearly equal, with five digits on each foot, and with traces of syndactylism. They were extremely numerous, and gave origin to the greater portion of the marsupials of Australia, designated under the name of Diprotodonts, a group of which the

[1] These fossils may now be seen in the Department of Geology in the British Museum (Natural History).—TRANS.

kangaroos form part. A few years ago no one would have suspected that these latter could have taken their origin in any continent other than that of Australia, and still less in Argentina, separated to-day from the Australian lands by the immense abyss of the Pacific.

These primitive Plagiaulacoidea or Diprotodonts were accompanied by the Pyrotheria (*Pyrotherium*), mammals of very variable size, with pentadactyl feet, the limbs in the form of perpendicular columns of support, a short neck, large head, square grinding teeth with two transverse ridges like those of *Dinotherium*, large upper and lower tusks as in the oldest Mastodonts, and a large trunk like that of the elephant. They are the stock whence have sprung the proboscidians which appear completely developed on the Euro-asiatic continent in the Tertiary period, their origin until now having been an indecipherable enigma.

Together with the Pyrotheria, there lived the Archaeohyracoidea (*Archaeohyrax*, *Argyrohyrax*, etc.), small plantigrade mammals half-hoofed and half-clawed, whose external aspect was that of a cavy (*Cavia*), and which have given origin to the Hyracoidea (*Hyrax*) existing in Asia and Africa, whose ancestors have not been known until now in these continents. The Notohippidea (*Morphippus*, *Rhynchippus*, etc.), small pentadactyl ungulates, but with the middle digit much larger than the side ones, constituted the stock from whence the horses have sprung. The Notostylopidea (*Notostylops*, *Trigonostylops*, etc.), whose dentition has a rodent-like appearance, and give rise to the Tillodonts of the northern hemisphere. The Isotemnidea (*Isotemnus*, *Trimerostephanos*) which probably represent the source of all the ungulates. The Homalodontotheria (*Asmodeus*, etc.), the oldest ancestors of the extinct Ancylopoda of Europe, Asia, and North America, curious and anomalous herbivores which possessed all the characters of perfect ungulates, except in the digits, which were bent in the form of hooks and armed with compressed claws like the unguiculates.

I have only mentioned a small portion of the ungulates of this period, which were very numerous. They were gigantic and with large tusks, like the Parastrapotheria, of medium size and generalised characters, like the Nesodonts and the Leontinidea; small, sturdy, and annectent forms between the ungulates and unguiculates, like the Hegetotheridea (*Prohegetotherium*), the Trachytheridea, and the Protypotheridea (*Archaeophylus*); tall and slender, like the deer, and with a single hoof on each foot imitating the horses in miniature, like the Proterotheridea (*Deuterotherium*), or with ambiguous affinities between the even and odd toed animals like *Didolodus*.

Of these different groups some few have completely disappeared, and the rest have dispersed over the Argentine Territory, passed on

to other regions, where by means of successive transformations they have given rise to the different orders of mammals which live, or have lived, in all parts of the earth. But besides these primitive mammals, which have left no successors here to reach to our epoch, one also meets with the ancestors of those which to-day are characteristic of our country, such as the hystricomorphous rodents and the opossums (*Didelphys*), which were represented by types more or less resembling the living forms, but exceedingly reduced in size. Together with the Peltateloidea (*Peltephilus*), singular armadillos with variable, pointed, bony horn-cores above the snout, there were already armadillos almost similar to those now living, by the side of others very different called *Palaeopeltis*, which gave rise to the Glyptodons of more modern periods, and sloths, generally small, but similar to those which later were destined to reach the gigantic size of the Mylodonts and Megatheria.

In a sentence, at the end of the Secondary period there lived in the Argentine Territory not only the ancestors of the mammals which inhabit it now, but also of those which live in all parts and all climates of the world.

The Secondary era closed and the Tertiary opened with a disturbance and a general change in the orography of the continents, and in the distribution of land and water. Great volcanic eruptions accompanied the elevation of the large mountain ridges previously only indicated, and the oceanic waters were shifted from north to south. The northern hemisphere was transformed into a continental one, and the southern hemisphere into an insular and peninsular one. The antarctic continent has remained split up, and the faunas of its different parts have thenceforward evolved separately. South America became reduced to an island of varying outline, and the ocean in this tremendous encroachment covered the territory of the Republic, rolling over the isolated sierras of the Pampa, reached as far to the west as the base of the first spurs of the Andes and the great mountain mass of the North-West. This land served as the refuge for the terrestrial mammals which were saved from the catastrophe. It was in the bottom of this ocean that the beds of the marine formation called Patagonian were deposited, which can be traced along the greater part of the Atlantic coast to the south of the Rio Negro, with a thickness at times of 300 metres, and corresponding to the middle or lower part of the Eocene period.[1]

During the Upper Eocene period another great upheaval of the land or a retreat of the ocean took place, the territory of the Republic rising again with its eastern shores more to the east than at

[1] The Patagonian formation has no species in common with the territory of Chile (excepting the system of Lebú), as I have said, but there are some in the formation immediately above, which is known as the Santacruzian.

the present time. Freshwater and atmospheric agencies accumulated on this newly-raised land the great Santacruzian formation, which, with a thickness of more than 200 metres, appears exposed in different parts of Patagonia, and especially in the region of the Rio Santa Cruz.[1]

The mammals which had taken refuge in the heights turned to descend to the plain, but already many had become extinct. The Hyracoidea, the Condylarthra, the Pyrotheria, and the Tillodontia had disappeared. Of the Notohippidea, previously so numerous, there scarcely remained any trace. The Ancylopoda had diminished remarkably in size and number. The Notopithecidea of the Cretaceous (*Notopithecus*, *Eupithecops*, etc.) had been transformed into the Homunculidea, which are the direct ancestors of the monkeys of both continents. The Typotheria and Astrapotheria had also begun to decline. On the other hand, the rodents, the Plagiaulacoidea, the Sparassodonta, the Nesodonta, and the Litopterna (*Theosodon*, *Proterotherium*, etc.) had increased in an extraordinary manner, the same as the armoured and unarmoured edentates. The groups of the Glyptodons and the Megatheria were already perfectly developed, but with representatives of a comparatively small size.

The data concerning the period in question are still much confused, but we know that at the beginning of the Oligocene epoch the Argentine Territory suffered a fresh submergence, accompanied by new volcanic and tectonic disturbances. The sea flowed back to cover the greater part of the plain, while the lava streams thrown out by the submarine volcanoes formed the sheets of basalt which cover like a black shroud the older formations of the Patagonian slates. Later, during the beginning of the Miocene, impetuous torrents brought down from the rugged, rocky heights granite and porphyritic blocks, rocks of all kinds, which, beaten by the waves of the sea, formed that great deposit of boulders which covers the surface of Patagonia without break from the Rio Negro to the Straits of Magellan.[2] The inhabitants of the plains migrated again to the heights, many of them perishing, others adapting themselves to the new conditions.

At the end of the Oligocene period the ocean made a retrograde movement, and took up the position it occupies more or less to-day, and the mammals returned to live on the plains, but again fewer than they had been. The Nesodonts, the greater part of the

[1] The Santacruzian formation exhibits a considerable number of species of fossil mollusca which are also met with in the Tertiary system of Navidad in Chile, which proves that both formations belong more or less to the same geological period.

[2] It is this formation which has been designated under the name "Tehuelche Formation." There have been recently found in it beds of fossil shells, which show that it is a marine formation, probably of the same epoch as the Tertiary system of Coquimbo in Chile.

Typotheria, the Ancylopoda, the Astrapotheria, the Peltateloidea, the Plagiaulacoidea, and the monkeys had disappeared. Of the Sparassodonta and Litopterna few traces remained. On the other hand, the Glyptodons and Megatheria, though in smaller numbers, were represented by forms which frequently attained a gigantic size. The hystricomorphous rodents had increased extraordinarily in numbers and size: the fossiliferous deposits of the Parana contain remains which indicate the former existence of mice of the size of oxen and horses.

Let us see what was happening meanwhile in the other continents. Since the submergence and disintegration of the Antarctic continent, Australia has remained isolated until our days; the primitive fauna of the Sparassodonts and Plagiaulacoidea, which were derived from the ancient Argentine continent, continued their evolution independently until they formed the Thylacines, the Dasyures, and the Kangaroos, living and extinct, of the same region.

South Africa, on the loss of its connection with South America, united itself with Asia, which already formed a continuous land with Europe; but the Atlantic, which extended over the Sahara as far as the Red Sea, opposed a barrier to the direct passage of the faunas of South Africa to Europe, and *vice versa*. On the other hand, with the continental transformation of the northern hemisphere, lands emerged, which put the Euro-asiatic continent in more or less direct communication with North America.

The ancient mammals of the Argentine Territory, which by reason of the submergence of the Antarctic continent had remained in South Africa, passed on at once to the Asiatic Continent, where they found conditions favourable to their development and evolution. The Pyrotheria developed into the Proboscidia, the Archaeohyracoidea into the living Hyracoidea, the Notohippidea into horses, the Condylarthra into Artiodactyles and Perissodactyles, the Sparassodonta into Creodonts and Carnivora, etc. The remaining South American mammals, such as the Monkeys (Homunculidae), the Hystricomorphous Rodents and the Opossums, invaded the Euro-asiatic continent by the same route. From Asia they passed on to Europe, and from Europe to North America, where they became specialised under different forms, each more bizarre and fantastic.

We return to South America. We find ourselves in the last third of the Cainozoic era at the end of the Miocene period. The mammalian fauna has continued to diminish in number. The Proterotheridea and the large rodents of the previous epoch have disappeared. Of the numerous order of the Toxodonts, there only remains the genus *Toxodon*, whose representatives attained the size of large rhinoceroses. The Megatheria and Glyptodons reached the

summit of their development, to end in those gigantic beings whose skeletons fill the galleries of the Museums of Buenos Aires and La Plata. The two Americas had been separated until now by the ocean, and the territories of Panama and Central America had been submerged in a deep sea which put the Atlantic and Pacific in communication.

Great tectonic movements produced a general raising of the mountain chains which traverse the New World from south to north, followed by a great retreat of the waters of the ocean. The continental mass acquired a larger extension, and both Americas were put into communication by the raising of a vast land-surface, in which to-day are the Gulf of Panama and the Caribbean Sea. The Galapagos Islands on one side and the Antilles on the other remained surrounded in this newly-risen land, and America in the form of a great rectangular continental mass extended from pole to pole.

The terrestrial faunas, confined hitherto by the inter-American sea, on the disappearance of this barrier began to move in opposite directions, that of the north towards the south and that of the south towards the north, producing a zoological interchange which had, as a result, the formation of a mixed fauna, whose origin has hitherto been a little inexplicable. Passing from the upper part of this recently-upheaved land, and describing a complete circle through time and space, there returned to Argentina many of the forms which had lived there during the Cretaceous period, but all of them modified and disguised. There emigrated at this epoch from North to South America the Mastodons, which had become extinct on the plains of the Pampa when, long geological periods previously, their forefathers the Pyrotheria disappeared from our land. With the Mastodons came the dogs, the felines, and the other carnivores descended from the ancient Sparassodonts, the llamas and the deer, the horses and the tapirs, which lived and multiplied on the Argentine plains by the side of the Toxodons, the Glyptodons and the Megatheria. But passing across these same lands the Argentine fauna advanced to the north and invaded North America. The clumsy *Toxodon* of our land was exterminated in Nicaragua. The heavy Glyptodons of the Pampa wandered away as far as Anahuac, where their carapaces are found on the slopes of the valley of Mexico in the neighbourhood of the city of the same name, and still further to the north in the surface deposits of the plains of Texas. The carpincho (*Hydrochoerus*) of the River Parana wandered as far as Florida accompanied by the *Chlamydotherium*, the most robust of the true armadillos which lived in our land. The gigantic extinct sloths of the Buenos Aires plains, the Mylodons and the Megatheria, advanced to a still greater distance, their remains being met with

in the States of Virginia, Georgia, Carolina, and in the whole of the valley of the Mississippi, mingled with the most characteristic representatives of the North American fauna.

We arrive at the beginning of the Anthropozoic era, and with it ceased the communication between the two Americas, the land which for a long time had united them being again submerged. We see then during the Quaternary times North America invaded by new forms; the Mastodons were replaced by gigantic elephants, accompanied by various other genera and species from the Old World. We see the *Elephas columbi*, the bisons, the *Equus tau*, and *E. conversidens* descending by the valleys of Mexico and advancing towards the south as far as the isthmus of Panama, but they found it interrupted and were not able to tread the South American soil.

A last retreat of the ocean which made itself felt over the greater part of the American coasts of the Atlantic left dry great shore banks of marine shells, like those of the neighbourhood of La Plata, which provide material for the building of this beautiful city, made by the genius and energy of our sympathetic rector [of the university]; this fresh continental encroachment upon the ocean again united both Americas, when the *Elephas columbi* and the other great mammals which had accompanied it in its migration to the south had already disappeared from the north. The bridge reappeared in the form of a narrow and tortuously long piece of land, which served from that time as a highway to the pre-Columbian peoples of our hemisphere who migrated successively, and backwards and forwards, from north to south, and from south to north, strewing the road with ruins, in which the mixture of a hundred peoples to-day misleads the cleverest investigators of the prehistoric past of the world of Columbus.

FLORENTINO AMEGHINO.

SOME NEW BOOKS

"Terra Australis Incognita"

The Naturalist in Australia. By W. Saville-Kent. 4to., pp. xv. 302. Illustrated by 50 full page collotypes, 9 coloured plates by Keulemans and other artists, and over 100 illustrations in the text. London: Chapman & Hall. 1897. Price, £3, 3s.

Naturalists of all classes, and a good many other people besides, including the inhabitants of the nursery, should be grateful to Mr Saville-Kent for producing such a magnificent picture book of the natural history of the most interesting and least known region of the earth, and for pouring out such a wealth of observation and entertaining anecdote as are to be found in his latest volume. We can attempt no summary of so discursive a work, but may perhaps give some idea of it by extracting a few of the new bits of information that it contains. The book is in some sense supplementary to Mr Saville-Kent's former fine volume on the Great Barrier Reef of Australia, reviewed in *Natural Science* for June 1893 (vol. ii., pp. 453-460), and deals chiefly, though by no means exclusively, with Western Australia, about which little has heretofore been written from the naturalist's point of view.

In chapter i. we are introduced to various aborigines of Western Australia, where they have been less exposed to the undermining influences of civilisation than in the more settled colonies. An advantage of civilisation, however, from the native's point of view, is the introduction of glass, whether in the form of bottles or telegraph insulators, from which wonderfully fine spear heads are manufactured, not by blows nor by breaking off with a bone, but by pressure with a hard stone or, preferably, a piece of iron. The frictional methods of kindling fire are described, but the author adds that they are seldom used—not because of the introduction of lucifer matches, but because it is the duty of the women to maintain the fire unquenched, and during migrations to carry lighted firesticks with them. This casts a light on the origin of the Vestal Virgins of antiquity.

A good deal has been written about the spurs on the hind feet of the duck-billed platypus. Mr Saville-Kent suggests that they are claspers used by the male (to whom they are confined) for the retention of the slippery female. Similar spurs are found in the male echidna, and in each case they are connected with a gland on the back part of the thigh. The echidna, also known as the spiny ant-eater, does not, it appears, eat ants at all—that is to say, not adult ants, but it breaks open the ant-hills and devours the nymphs, larvae, and pupae.

Another error common to the text books, is the representation of phalangers flying from tree to tree in a horizontal position or with the head lower than the rest of the body. The truth, according to our author, is that the head and shoulders are always kept at the highest level, with the forearms outstretched ready to grasp the first object

reached. It is a pity that the photograph given is no proof, owing to the absence of accessories.

Passing from mammals to birds, we regret to learn that the lyre-bird, *Menura superba*, is in danger of extinction. At the same time we can hardly wonder at it, since it is the supposed duty of every globe-trotter to bring home for his female relatives, present or future, a pair of the splendid tail-feathers to which the bird owes its name. In the excellent chapter on birds the greatest space is devoted to the fern-owls, *Podargus strigoides;* and the humorous series of photographs, illustrating the remarkable changes of form and expression in these quick-change artistes, should render them familiar in our mouths as household words. The familiar name, however, "more-pork," is based on a misapprehension, since the bird which utters this melancholy cry is really *Ninox boobook.* Other birds on which valuable notes are given are the Queensland shrike (*Cracticus torquatus*), the N. Queensland laughing jackass, various finches (*Poephila*), and the firetail (*Estrelda bella.*)

Zoologists will not be surprised to find a large space devoted to the frilled lizard, *Chlamydosaurus kingi*, since they will all be familiar with the interesting observations that Mr Saville-Kent has published on this reptile. Reptile one must call it, though its favourite mode of progression is rather that of the Anglo-Saxon messenger in "Alice through the Looking-glass," as shown in the figures. Another text-book error is to represent this animal with its frill extended, but with its mouth closed, a physiological impossibility, for the frill is supported by processes of the hyoid or tongue-bone, which are pressed out by the fall of the lower jaw. The bearded lizard (*Amphibolurus barbatus*), the mountain devil (*Moloch horridus*), the stump-tailed lizard (*Trachysaurus rugosus*), and many others are vividly brought before us by the author's pen and camera.

Chapter iv. introduces those marvellous structures, the homes of the termites or white ants, and gives some striking photographs of them. Among other things not generally known, we are told that both termites and termitaria may be used as food. The animals themselves, though eaten in Africa and India, do not yet grace the menu of Australian colonists or black-fellows, but the latter satisfy their hunger with the earthy substance of the mounds, which contains a large amount of proteaceous matter in the form both of termite-secretions and of microscopic fungi. Here we may also note that the green ants, described in another chapter, make, when mashed up in water, an acid drink pleasant to the European as well as to the native palate. Perhaps Mr Saville-Kent knows that Swedish children acidulate lump-sugar by leaving it in an ant-hill for half-an-hour. As for the food of the termites themselves, it is only too well known by those who have spent any time in our southern colonies, that many species have such a craving for wood that they will eat one out of house and home if constant care be not exercised. Their efforts produce a result like the sleeping palace of the fairy-tale, in so far as furniture and walls are outwardly sound but crumble to dust as soon as touched. There is therefore some consolation in learning from this book that the mound-builders do not eat wood but grass, sallying forth from their fortresses by night along hastily constructed

covered ways, reaping the harvest, and garnering it for future use. It is probably the silica contained in the grass-stalks that imparts such firmness to the walls that these Neuroptera build. Before leaving them, we notice a figure, here published for the first time, of an infusorial parasite of the Tasmanian termite, described by Mr Saville-Kent under the name *Trichonympha leidyi.*

Though this volume does not deal with marine life to the same extent as did its author's last monograph, yet room has been found for a fascinating account of the island group known as Houtman's Abrolhos, off the coast of Western Australia. Here, in consequence, it is conjectured, of a southward flowing current from the Indian Ocean, there is a tropical marine fauna, including coral islands in all stages, situated in a temperate climate, and only a few hours' sail from the port of Geraldton. Mr Saville-Kent urges the advantages offered by Houtman's Abrolhos for the foundation of a biological station, and his account inclines one to cut the painter of bread-winning necessity and set sail for these Treasure Islands without delay. The guano, for which these islands are worked, need not deter us, for it is "absolutely devoid of smell." This, however, does not suit the farmer, who values his manure by its stink; and appropriately malodorous chemicals must be added before the guano can be placed on the market. Upon these reefs we shall find specimens of the corals which Mr Saville-Kent here describes and figures, apparently for the first time, as *Madrepora protaeiformis* [*sic*] and *Montipora circinata.* Another new species, that may be found here, is the magnificent nudibranch mollusc *Doris imperialis*, which forms the subject of a coloured double-plate.

Brilliancy of colour also characterises many of the fish found in Australian waters; and that the chromo-plates of Syngnathidae (sea-horses) and Plectognathi are far from exaggerated in this respect will be admitted by anyone who has visited the little aquarium started at Hobart by Mr Saville-Kent himself. That these colours are more brilliant in the mating season, and therefore due to sexual selection, is not proved for all species, but is known to be the case with *Monacanthus rudis*, even as it is with our familiar stickleback. A very important observation recorded by our author is that on the latent colour-markings of certain fish. In the daytime longitudinal colour-bands are conspicuous, but at night there appear further dark transverse markings. These markings, controlled by the nerve-centres in the adult (as proved by a blinded fish, which behaved as though it were always night) are, in some cases at least, constant in the young, a fact suggesting that the species are derived from transversely-banded ancestors.

Chapter vii. does for the pearl-fisheries of Western Australia what the author's former work did for those of Queensland. We are not surprised to read that Mr Saville-Kent has unpleasant memories of wading ashore through the mud-flats of the port of Broome, which is the headquarters of the pearl-fishing fleet, and we are happy to be able to assure him that the substantial jetty for which he longs has already been built, and that from it there embarked as many as fifty passengers only a month or two ago.

Marine miscellanea are dealt with in the following chapter, which

contains the account of a remarkable anemone, *Acrozoanthus australiae*, that builds itself a home on the outside of the tubes of a nereid worm. This the worm does not like, and stretches out its habitation in another direction. The anemone, equal to the emergency, follows the new branch, whereupon the worm strikes out again like a doubling hare. The process continues till the anemone secures its inevitable victory, and results in the formation of a singularly regular zig-zag polyp-stock. Many of these polyparies grow side by side on submerged rocks, sticking upwards when covered by water but hanging down when exposed by the ebb of the tide like the corkscrew ringlets of an old maid. We feel it our duty to note that in this chapter another new species of coral is proposed, "provisionally associated with the title of *Turbinaria revoluta*." Some day naturalists will recognise the futility of excusing their new names on the ground of their "provisional" nature. At present the phrase is generally diagnostic of the amateur, and should be shunned by so accomplished a naturalist as Mr Saville-Kent.

Insect oddities and vegetable vagaries are the titles of the last two chapters, to which space does not permit further allusion. It is, however, in these that some of the most beautiful illustrations of the volume are contained, notably of the shy-flowering cacti. Of the other illustrations, those of most interest to the naturalist are of the animals taken under water; and in this new branch of photography the author has made good progress since we first had the pleasure of calling attention to his efforts. The group of holothurians (*Colochirus anceps*), is a notable and instructive example of this *genre*. A word of praise is due to Messrs Waterlow, whose reproductions and printing do the fullest justice to the art of the author. The chromo-plates are ambitious, but, with the exception of plate 4, representing a madrepore-reef, and Mr Frohawk's drawing of *Chlamydosaurus*, they do not appeal to us. The attempt to reproduce the vivid colours of the animals results in glaring masses devoid of life and natural chiaroscuro. It is with the camera pure and simple that the author is most successful, and he has learned the art of applying the scissors to his photographs with the happiest results. We wish, for his own sake, that he would apply those useful instruments to his prose. His golden rule is: never use one syllable when a word of four syllables is to hand, never use one word when six will do, and don't bother too much about the meaning of your phrases. When he wants to tell us that a certain lizard will eat any food, he says "the gastronomic proclivities of Trachysaurus are essentially omnivorous," and it amuses him to speak of a hansom cab as "that indispensable anticlimax of British Citizenship." To photograph an animal is "to immortalise it with the camera," an expression which shows that the author properly appreciates his own work. Neither can we fail to be struck by the number of slips in the names of people, and even in some of the long words so dear to him. Thus we find H. F. Blandford for W. T. Blanford, J. D. for G. D. Haviland, R. C. for A. C. Haddon; Gunther for Günther, Rontgen for Röntgen; R. M. Johnston of Hobart is called Johnson, though he must be well known to Mr Saville-Kent: even four of the officers at the very museum where the author was formerly an assistant are incorrectly referred to; Ipswich is confused with

Norwich. The bushman who says "triantelope," or, as we have heard, "triantulope" instead of turantula, is said to be "less illiterate"; what particular malapropism ought we to apply to a scientific writer who uses such unusual spellings as "chaelae" "fulchra," "mede," "Myrmicobius," "vestigeal," "synonomy," "Ostraea," "Geomiter," "Rhoea," and "spinnaret"? If, as our author might say, this sumptuously embellished volume be dedicated to a public with a predilection for the literary pabulum furnished by the now senescent lions of the *Daily Telegraph*, then our critical shafts are supererogatory. But the book deserves a higher circle of readers and a longer life, and therefore deserved a trifle more trouble in the preparation. Let Mr Saville-Kent learn, before it is too late, that one cannot take a snap-shot at immortality.

The Fossil-spotter's Manual

Die Leitfossilien. Von Ernst Koken. 8vo, pp. 848, with about 900 illustrations in the text. Leipzig: C. H. Tauchnitz, 1896. Price, 14 marks.

The object of this book is not to teach palaeontology, but to present the geologist with a means of discovering for himself the genera to which his collected fossils belong; the book may be described, in brief, as a guide to fossil-spotting. The aim is not one with which we have great sympathy; but within limits such a work is of value. Dr Koken will certainly have done good service if his book leads any geologists or others to pay more attention to the essential diagnostic characters of genera and species, as detailed by their authors in the text of their monographs, and to rely less on the superficial features shown in the illustrations, which, as every worker knows, are often incorrect.

The book is professedly incomplete, dealing as it does only with Invertebrata, and omitting even from them such forms as are not of much use to the stratigrapher. All the Tertiary species, too, find no place in the second half of the book, although the more important genera are discussed in the systematic section. The illustrations also though many are good, are very unevenly distributed. A book of this kind needs more diagrams, such as those of *Cardinia* (p. 200), *Megalodon* (p. 205), goniatite suture-lines (pp. 60, 61), and trilobites (p. 18), and can well spare elaborate pictures, such as that of the rare Silurian *Pollicipes* (p. 6, or the uninstructive *Polyjerea* (p. 332). Illustrations that suited Dr Koken's excellent semi-popular work "Die Vorwelt" (see *Natural Science*, vi., pp. 127-129, Feb. 1895) are not adapted to the present student's manual, however much the publisher may wish to utilise old clichés.

The first part of the book consists of a series of analytical keys, arranged in the form of short paragraphs, each connected by reference numbers with those that follow. It is an attempt to reduce dichotomous tables to the requirements of the printed page, and is at first somewhat perplexing. Let us try it in practice. Here is a small brachiopod from the Upper Chalk. Section I. is "without hinge"; this has a hinge: turn to section II. II. A. are forms without free

arm-skeleton; our fossil, however, has an arm-skeleton consisting of a narrow loop, which projects forward into the shell cavity, and this places it in II. B. c. 2. The first sub-division of this is according to the length and curve of the loop, and our brachiopod agrees with the second paragraph, "Loop recurrent, long. 11." Turning to 11, we read "The loop free," which does not agree with our specimen; and then, "The loop again fixed to the median septum of the small valve. 16." Reference to 16 again gives us two sub-divisions, the first of which includes shells that are "Smooth, . . . have large foramen, and rudimentary deltidium. 17." Number 17 includes 3 genera, *Kingena*, *Magas*, and *Rhynchora*. *Kingena* has "median septum in the large valve," and a "cross-band connecting the recurrent loop-bands"; these structures are not found in our fossil. *Rhynchora* has "hinge-line straight, long, large valve with area"; this also does not fit. We are therefore restricted to *Magas*, and find in fact that the specimen agrees with the characters here ascribed to that genus. Now this is admirable, and as scientific as it is possible for such keys to be. But how often will the student or the field-geologist have a specimen of *Magas pumilus* showing all, or even a few, of the necessary characters? Not one specimen in a hundred shows them. In fact Professor Koken himself says of the Brachiopoda: "Since the delicate calcareous bands are usually destroyed or only discoverable by laborious preparation, other characters have to be used in practice." In short, give the student a decent work of reference, such as Davidson's Monograph or the "Paléontologie Française," and he will have determined genus and species long before you have made up your mind whether the specimen has a brachial skeleton at all. The truth is that the principles of classification are one thing and the methods of fossil-spotting are another. The first essential for the latter is an extensive acquaintance with specimens. Any collector of Chalk fossils can tell *Magas pumilus* if he has once seen it. When he has this acquaintance, then he can proceed to the true knowledge required for the best systematic work. We must learn these concrete sciences like we learn a language: get a good vocabulary first, and proceed to the structure and syntax afterwards.

The second section of the book gives short diagnoses of the chief species characteristic of the various formations, and is to be used after one has determined the genus. It is inevitably incomplete, and chiefly intended for German students. Even for the fossils of Germany it is not to be relied on without confirmation by the more complete original monographs; and this being so, it is a pity that there are no references to literature. The fortunate collector of a *Taxocrinus rhenanus* certainly should not be able to identify it as a *Cyathocrinus*, the genus in which Dr Koken leaves it. Some of the genera and species to which reference is made, especially among the Gastropoda, we have been unable to discover in literature at all, and have a strong suspicion that they are here introduced for the first time (*e.g.*, *Ectomaria*, p. 395). This is undoubtedly the case with the name *Amorphocystites*, introduced in a footnote (p. 411) as proposed by Jaekel for *Caryocystis testudinarius* Von Buch and *C. pumilus* Eichwald. It is very doubtful if any such change of nomenclature be needed; and in any case this hole-and-corner method of bringing out new names has never yet been

productive of aught but confusion, and we are astonished to find it adopted by so careful a worker as Professor Koken.

We realise the enormous labour expended on this work, which may be of use to many under the guidance of a good teacher, and as a supplement to scientific palaeontology on the one hand and to field-work on the other. But we ourselves prefer Professor Koken when playing his other parts of original investigator or high-class populariser.

Miniatures by Hansen

The Choniostomatidae. A Family of Copepoda, Parasites on Crustacea Malacostraca. By Dr H. J. Hansen. 4to, pp. 206, with thirteen copper plates. At the expense of the Carlsberg Fund. [Author's Motto:—"We want facts, not inferences, observations, not theories, for a long time to come."—*Natural Science*, 1896.] Copenhagen: Andr. Fred. Host & Son, 1897.

Within the memory of men still living an artist could obtain a respectable reputation and a good income by painting miniatures. The features of the original might reach any assignable degree of the plain and the commonplace. It mattered not; the portrait on ivory was always like and always lovely. All this delightful flattery has been destroyed or banished by photography, cheap and (sometimes) cruel. But Dr Hansen's volume proves that there are mysteries of portraiture with which the camera is still incapable of dealing. Though the likenesses are not those of decorated officers or fashionable beauties, but of forms more fitted to excite wonder than admiration, the picture of each is drawn by him with exquisite delicacy of touch and the most minute attention to detail. Each is confined within the compass of an inch or two. But really this is a gigantic enlargement. The true miniature is the natural object, often only one-hundredth of an inch in length, and sometimes much less. Under a powerful microscope animals of this size may become decently conspicuous. The same can scarcely be said of the mouth, which in the Choniostomatidae is not only absolutely but relatively small. It may be left to professed arithmeticians to calculate the dimensions of their two pairs of antennae and three pairs of jaws and the joints thereof, all which need observing for purposes of full and accurate scientific description. When it is added that the animals are not transparent, and that they will not submit to pressure, the microphotographer will probably leave them for the present, without attempting to challenge the deftness of Dr Hansen's pencil.

For the neglect which this curious family has till lately experienced there is more excuse than usual. The poet might bewail that in labouring to be short he became obscure. These Copepoda were probably short without labour and obscure by preference. How else can we account for their choosing to belong to the neglected class of crustacea, choosing a life of self-effacement within that class, choosing their hosts chiefly among its unpopular and little known sessile-eyed groups, and burying themselves for the most part in brood-pouches and branchial cavities? To be plain, they are crustaceans parasitic on crustaceans principally on Amphipods, Isopods, and Cumacea, having been found in only a few instances on stalk-eyed shrimps. A solitary species courts the public gaze on the outside of its host's body.

Some prejudice attaches to the habit of existence in which these creatures indulge. On the other hand, the Parasite in Lucian maintains that his profession and personality are the true charm and glory of social life. The parasite in zoology may urge in its own favour that it is an eminent preacher and teacher of cleanliness, and an unanswered advocate for the theory of evolution. The family Choniostomatidae is at present divided into six genera. Forty-five species are known, chiefly through Dr Hansen's researches. The first published, however, was *Sphaeronella leuckarti*, described by Salensky in 1868. Thus, so far as their history is known, it is open to suppose that the whole batch has been specially created within the limits of the present century. But the reverential motive which prompts hypotheses of that kind is surely undermined when they require us to contemplate one set of crustaceans as specially contrived to live and multiply, and another set of crustaceans as specially contrived to be vampyres on the first set, and to stop them from breeding. The latter strange effect produced by the presence of some crustacean parasites on their crustacean hosts was first expounded by Prof. Giard. Dr Hansen finds reason to believe that, as a rule, with the exceptions to which all rules are liable, the Choniostomatidae prevent their entertainers from rearing a family. With the opinion advanced by Giard and Bonnier in regard to the Epicaridea, that each parasite has its particular host, and is found on no other species, he does not fully agree, and he also adduces evidence to show that such a rule is not applicable to the whole of the present group. Certain members of it have been discussed by the French authors just mentioned, and some of their results are subjected to rather severe criticism. This, amid the intricacies of a new subject, will be highly acceptable to the general reader. Apples, for choice, need a subacid flavour. They must not be so sharp as to set one's teeth on edge. As the eminent authors reciprocally compliment one another in the names of the new species, there is evidently here no very desperate quarrel. By the extraordinary patience with which during several years Dr Hansen has been accumulating his observations he is entitled to be a little intolerant of more rapid methods, which cannot fail to be hazardous in a material so difficult. The remark which he quotes on his title-page, "We want facts, not inferences, observations, not theories, for a long time to come," is from *Natural Science* itself, so it must be true, and a paragraph of his own, beginning, "Now-a-days many authors have a remarkable weakness for publishing innumerable immature notes," deserves cosmopolitan circulation. In another passage Dr Hansen says, "I confess that, though I honour everybody who is capable of suggesting a theory which proves to be well founded and fertile in results, I have always felt, and, as time goes on, feel more and more distaste for superficial conjectures." But this is almost like saying, "There are too many anglers; what we want is fish." People will go on angling to please themselves, without regard to what we want. Allowance must be made for differences of temperament and taste. Some misguided persons hear of the discovery of new families, genera, and species with a stolid want of enthusiasm. They perhaps for their part think nothing important but the course of the nerves or the action of the hepatopancreas. Mr Henslow dismisses the origin of

species by means of natural selection as a superficial conjecture, and hopes for a speedy recognition that Darwin's deduction, as he calls it, was a most unfortunate one. Supposing it to have been so, the world could well do with one or two more misfortunes of a similar kind.

Dr Hansen's book is in English. This is evidently part of a conspiracy to discourage the English-speaking peoples from studying foreign languages, a plot in which Russia has, unfortunately, not yet joined. The translation from the Danish manuscript has been well executed by Miss Louise von Cossel. It is unlucky that one frequently recurring word has been too literally rendered 'list,' not in any of the accepted English senses of the word, but to signify a ridge or linear prominence, or possibly a seam or an unraised line of hardening of the integument. In naming the mouth organs Dr Hansen himself adopts the terms maxillulae and maxillae, respectively for the first and second maxillae, on the analogy of antennulae and antennae for the first and second antennae. The great objection to these terms is that sometimes the first maxillae and the first antennae are larger, even very much larger, than the second, and then the diminutives are misleading. As a matter of fact, in a paper published only last year by F. Vejdovsky, the second antennae are called the antennules. The confusion is not unnatural in describing Amphipods, which often have the second antennae shorter than the first, occasionally less than one-fifth as long. But these are not matters of vital concern. For the pith and marrow of the research the reader must have recourse to Dr Hansen's volume. It is a masterly piece of work, which will confirm and increase his high repute as a naturalist of distinction.

T. R. R. S.

Prehistoric Problems, being a Selection of Essays on the Evolution of Man and other Controverted Problems in Anthropology and Archaeology. By Robert Munro, M.A., M.D. 8vo, pp. xix. + 371. London: Blackwood, 1897. Price, 10s.

In these days of scattered scientific literature, the bringing together into a single volume of a number of essays by one author is a very desirable thing, particularly when, as in the present instance, the author is a scientist of distinction. Although the volume contains comparatively little that has not already appeared in print, Dr Munro's newly-published selected essays on "Prehistoric Problems" will be welcomed by many as a valuable addition to Archaeological literature. The book consists of a number of chapters, each of which is a separate and distinct essay. This collection of essays is of a decidedly heterogeneous nature, comprising as it does so varied a selection of subjects as: The Rise and Progress of Anthropology; Man's Antiquity and Place in Nature; Prehistoric Trepanning; Otter Traps; Bone Skates; and Prehistoric Saws and Sickles. The very varied nature of the subjects discussed imparts a character of inequality to the volume, and imposes a certain lack of proportion, which is evident to the reader who, taking the book as a whole, would read it straight through from beginning to end. Taken individually, the essays are decidedly both instructive and interesting, and the first four, which form Part I. of the volume, may well be taken together, as they form a very fairly connected and consecutive series.

They chiefly deal with the Antiquity of Man and his Place in Nature, together with a brief history of the scientific study of Anthropology, a field wide enough to have filled the whole volume, and one which we would gladly have seen treated in a more complete and less condensed manner by Dr Munro. So far as the allotted space admits the subject is skilfully handled, and the points are clearly brought out; the style, too, is simple, so that it does not require a trained scientific mind to grasp either the general conclusions or the details. The first part of the book is, in fact, well suited to the general reader, as well as of value to the scientist. Dr Munro is hopeful in regard to the possibility of bridging over the gap between the Palaeolithic and Neolithic civilisations in Western Europe, and advances the important finds of M. Piette in the Mas-d'Azil cavern, and the curiously similar finds in a cave at Oban described by Dr J. Anderson, as helping possibly to link the two periods. The evidence of a continuity between the two periods is not as yet sufficiently complete, but a step has been made in the right direction, and Mr A. Evans' researches in the Balsi Rossi caves are much to the point in this connection.

One of the most interesting essays in the book is that dealing with the importance of the assumption of the Erect Posture as a factor in the physical and intellectual development of Man. Dr Munro is a strong advocate of the enormous advantage which Man derived from the attainment of the erect posture, and the consequent differentiation of the limbs into hands and feet; in other words, the releasing of the fore-limbs from locomotive duties, so that they might become the servants of the brain in other directions, and thus assist the development of mental qualities. The position of *Pithecanthropus erectus* in the human phylogeny is reviewed in a judicial manner, and it is pointed out how the calvaria and femur of this seemingly intermediate type bear out the theory of the erect posture having preceded the higher development of the brain in Man.

A slight rearrangement of the material in Chapters II. and IV. would have obviated a certain amount of repetition in connection with this point.

The second part of the volume, headed "Archaeological," comprises four essays on quite distinct and unconnected subjects. These will probably appeal less to the general public than those contained in Part I., as dealing with more special points of archaeological interest. The chapter on "Prehistoric Trepanning" is well worth reading, and the subject is rather to the fore just at present, it having been discovered that, in addition to the interest attaching to the primitive surgical methods adopted in conducting so important an operation, and the fact of the patient having so frequently recovered, there is also a good deal of folk-lore connected with the practice, well worthy of study. Dr Munro has brought together, in Chapter VI., all the available data regarding the curious wooden objects which he on fairly good grounds calls "otter and beaver traps." He handles the subject with skill, and, in the absence of direct evidence, the probable use of these objects can only be arrived at by comparative study of the examples. Space does not allow more than the mere mention of the essay on "Bone Skates," whose claims to be in some instances considered as prehistoric are called in question, and that on "Prehistoric

Saws and Sickles," in which is given an excellent general account of these implements, together with views on such controversial matters as, for instance, the use of the wooden-handled flint "saws" from Polada, which Mr Spurrell regards as sickles allied to those found by Mr Petrie at Kahun.

The illustrations are numerous, and for the most part good; the text is not always free from blemish, in the shape of curious printer's errors, which have survived the proof-reading ordeal; there are also sundry awkwardly turned sentences. These, however, do not in any way affect the value of the work, nor do the unimportant, if inartistic slips, impair our indebtedness to the author. H. B.

Some Elementary Text-Books.

First Stage Physiography (The Organised Science Series). By A. M. Davies. 8vo, pp. viii. 238, with 110 illustrations. London: W. B. Clive & Co., 1897. Price, 2s.

Elements of Physical Geography. By S. B. J. Skertchly. 28th Edition; revised by J. H. Howell. 8vo, pp. viii. 224. London: F. Murby, 1896. Price, 2s.

A Text-Book of Geology. By W. J. Harrison. 8vo, pp. viii. 343, with 140 illustrations. London: Blackie & Son, 1897. Price, 3s. 6d.

First Stage Mechanics of Fluids (The Organised Science Series). By G. H. Bryan and F. Rosenberg. 8vo, pp. viii. 208, with 77 illustrations. London: W. B. Clive & Co., 1897. Price, 2s.

First Principles of Natural Philosophy. By A. E. Dolbear. 8vo, pp. x. 318, illustrated. Boston, U.S.A., and London: Ginn & Co., 1897. Price, 4s. 6d.

The constant alterations in the syllabus for Physiography in the Science and Art Department's examination render necessary a continual series of new or greatly revised text-books. Mr A. M. Davies' "First Stage Physiography" will, therefore, no doubt be extremely useful. It has all the merits of a good elementary text-book; it is concisely and clearly expressed, it is thoroughly reliable and up to date; it is illustrated by a series of well-selected diagrammatic figures of which many are new; and the definitions are explained by homely illustrations which are so chosen as to be very suggestive to an intelligent student. The only point in the book we regret is the use of the metric system for all dimensions, an innovation in an elementary book on this subject which we think hardly likely to lead to accurate perception among students. It was perhaps a pity to refer to a lustre in the explanation of the form of a prism; for as the point in which students most often go wrong is by regarding a prism as a triangular pyramid, an error for which comparison with a lustre, which has a pointed end, is apparently generally responsible. It is not quite correct to say that the snow-line reaches the sea-level in Greenland. But except for one or two trivial points like these, there is nothing in the book with which we can find fault. We can only wish the book the circulation it deserves.

Opportunity has been taken of the issue of a 28th edition of Skertchly's small "Physical Geography" to subject it to extensive revision, which might, however, have been made even more thorough. The book, as it now stands, has many good points, the chapter on "Astronomical Relations" being probably the best; subjects such as the precession of the equinoxes, and the method of finding latitudes are generally stumbling blocks to the beginner, but they are here clearly explained. The main points to which the editor might attend

in the preparation of a future edition is greater uniformity of standard, and the reduction in number of needless technical terms. In regard to the latter, the editor even proposes new terms in the course of the book, describing some springs as "transtatic." Even if the term were useful, its first publication in a shilling text-book could hardly be commended. The restriction of "isothermal" to mean annual temperature is neither usual nor convenient. There are still many points in which revision is necessary; Africa is not now regarded as exempt from earthquakes (as stated on p. 154); it is too late to say that the cause of the rising of the Nile is covered by "much obscurity," or to affirm that glacier ice is "not plastic." The geological classification of lakes into two divisions only (p. 111) is quite inadequate, while it is only burdening a student with useless definitions to separate rivers into oceanic and continental, according to whether they flow into the ocean or not. The appendix on the geographical distribution of animals could do with thorough revision: *Colubus* is not a "tail-less ape" (p. 209); and to say that the long-tailed manis and the ground-pig are "almost exclusively African" is an error from excess of caution; the python is not only found in the Indian region; *Lepidosiren* is not a reptile, and it is not excusable now to include the crocodile among the lizards.

Mr W. Jerome Harrison is a very experienced science teacher, a practical geologist, and has always shown himself a painstaking and accurate worker; hence it is not surprising that his "Text Book of Geology" has reached a fourth edition. It now appears so much enlarged and revised that it is practically a new book. The syllabus for geology issued by the Science and Art Department is reprinted at the end, accompanied by the questions set at the May examinations for the past eight years. This fact suggests the class of students the author wished to help; and for the elementary stage of that examination we know of no better class-book. The book is, as a rule, reliable and well up-to-date; but we notice a few old figures that might have been omitted, and a few points that might be revised. The author might have added the supposed land plant *Berwynia* to the list of his pseudo-fossils, instead of accepting it as unhesitatingly as he has done on p. 177. The pre-glacial age of man is not proved by either the Cae Gwyn Caves or the Brandon implements. The explanation of the Moel Tryfaen shells as "*pushed up* to their present heights in front of" a glacier [the italics are Mr Harrison's] is one of the type of explanations which prejudices the anti-marine theory. The statement (p. 186) that crinoids "are dying out, a few specimens only lingering at the bottom of the deep seas," is a survival from twenty years ago, which still lingers in many elementary works. Another common mistake is regarding the Neocomian as the equivalent of the whole of the Lower Cretaceous. The illustrations are numerous and good, and we hope the book will soon reach a fifth edition.

The fourth and fifth books are not quite within our range; but geographers and geologists occasionally have to deal with questions to which some knowledge of the mechanics of fluids is essential. We therefore need make no apology for calling attention to works in which the elementary principles of the subject are clearly and simply taught.

The Nectaries of Flowers

Beitrage zur Kenntnis der Septalnectarien. By J. Schniewind-Thies. 8vo, pp. 87, with 12 plates. Jena: Gustav Fischer, 1897. Price, 15 marks.

This volume, with its large well-spaced text and its beautiful supply of nicely lithographed plates, including 266 figures, once more brings home the fact of the extreme specialisation of present-day science. It is surprising to know that Mr Gustav Fischer can find it worth while to publish at fifteen shillings an independent work dealing with a special kind of simple honey-secreting tissue, and containing about as much matter (if we except the plates) as half of a single part of our Linnean Society's Journal.

Septal nectaries are the honey-secreting layers found, sometimes on the outer surface of the ovary, but generally in the walls separating the ovary chambers, in many genera of Liliaceae and other petaloid monocotyledons. They have attracted the attention of various botanists during recent years, and we could add to the references to papers cited in footnotes by Mr Schniewind-Thies. The author gives an account of the structure and position of the nectaries in genera of Liliaceae, Amaryllideae, Scitamineae and Bromeliaceae, and distinguishes seven groups. In the simplest the secretion is effected by the epidermal cells of the whole exterior surface of the ovary, from its base to the origin of the three style-arms. The only examples given of this are in two species of *Tofieldia*, one of the simplest genera of Liliaceae. In the second group a "double nectary" is found, secretion occurring on the surface of the ovary in three furrows lying along the septa, and in three slits which permeate the separating walls of the carpels. Examples are found in *Yucca* and *Agapanthus*. In the third group there are no superficial glands, secretion occurring only in true septal slits as in *Funkia* and species of *Allium*. Where the ovary is only partly superior a double nectary may occur in the upper part and internal ones only in the lower, as in *Haworthia* and *Urginea*, or only in the inferior part, as in *Phormium* and other Liliaceae, where a further complication ensues in lateral branching of the slits and strong development of vascular tissue in their vicinity. Where the ovary is wholly inferior, as in Amaryllideae, Irideae and Scitamineae, and some Bromeliaceae, secretion is confined to three septal slits, or occurs also in three outer furrows at the thickened style-base. In Bromeliaceae, with a superior or half-inferior ovary, the most complicated arrangement is found, since, besides the double nectary as described for the second group, there are also three internal glandular surfaces penetrating the dorsal suture of each carpel, and opening upwards into the ovary-chamber. Thus, it is suggested, increased complication in the form of the nectary accompanies a similar change in final complexity. In the second part of the paper the histology of the secreting cell and the part played by the various constituents of protoplasm and nucleus are discussed. In conclusion, we must again refer to the great number of excellent drawings, which add greatly to the interest of a communication consisting largely of somewhat detailed structural and histological descriptions of individual cases.

The Origin of the Diamond.

Papers and Notes on the Genesis and Matrix of the Diamond. By the late Henry Carvill Lewis: Edited from his unpublished MSS. by Professor T. G. Bonney, D.Sc., etc. London: Longmans, Green & Co., 1897. Pp. 72, with 2 plates and 35 figs. Price, 7s. 6d.

The late Professor Carvill Lewis was much interested in the remarkable occurrence of the diamond at Kimberley, and shortly before his death devoted considerable care to a study of the rock in which the diamonds are found. He communicated two papers on the subject to the British Association in 1886 and 1887 with the intention, apparently, of continuing his researches and of writing a book on the general question of the origin and occurrence of the diamond. This work was cut short by his premature death, and the present volume contains merely the full text of the two British Association papers, with a few notes and an appendix by Professor Bonney.

The most diverse opinions have been held regarding the nature and origin of the peculiar rock, known as "Blue Ground," in which the diamonds of Kimberley are embedded. A vertical column of serpentinous material, unlike anything else upon the surface of the earth, extending to an unknown depth, and of enormous dimensions, it was supposed by some to be the neck of a volcano, by others to be a volcanic breccia due to a sort of mud eruption. The object of Professor Lewis's papers is to show, by an elaborate and minute microscopic study of the rock itself, that it was a true igneous lava, or, to use technical language, the 'Blue Ground' was, according to him, a porphyritic volcanic peridotite or basaltic structure, an olivine-bronzite-picrite-porphyrite, rich in biotite (now very much decomposed), and for this remarkable rock he proposed the name "Kimberlite."

The chief argument upon which his conclusions were based is that in two American localities, namely at Syracuse, New York, and in Elliott County, Kentucky, a precisely similar rock occurs, though without diamonds, and is there obviously an eruptive rock. Professor Bonney's appendix consists of a detailed description of these two rocks, which he also regards as practically identical with "Kimberlite," although he does not quite agree with Professor Lewis's views concerning the origin of the latter.

It has generally been supposed that the diamonds in the blue ground were either caught up from some underlying rock or are due to the fusion of the carbonaceous shales through which the blue ground passes, or are decomposition products. Professor Lewis emphatically states his opinion that the diamond is an essential constituent of the rock like any of the other minerals which it contains; in this view he probably stood alone at the time of his death, and it is not one which has been generally accepted since.

It cannot be said, therefore, that these papers contribute much to our knowledge of the origin of the diamond; they constitute a careful description of the rock in which the precious mineral occurs and establish the existence of a similar rock elsewhere, but no reason is suggested why it only contains diamonds at Kimberley.

Professor Bonney has done well in giving these posthumous papers to the world, and has considerably enhanced their value by

appending his own description of the American Kimberlites. As he states in the preface that he has purposely avoided all reference to more recent literature, the reader must be content to miss any allusion to the occurrence of diamond in meteorites, although the resemblance between Kimberlite and certain meteorites is frequently mentioned, neither will any account be found of recent experiments upon the solvent action of the blue ground upon diamond, or of the artificial production of the mineral.

For these reasons the book can only be regarded as a publication of papers that should have appeared ten years ago, which, though interesting and important as a petrographical study, do not throw much light upon the vexed problem of the genesis of the diamond.

H. A. Miers.

Landslips.

Report on the Geological Structure and Stability of the Hill-Slopes around Naini Tal. By T. H. Holland, Officiating Superintendent, Geological Survey of India. Pp. viii., 85, with a map and 11 plates. Calcutta: Office of the Superintendent of Government Printing, India. 1897.

This report shows the practical value of a thorough knowledge of the geological structure of a district as affecting its suitability for habitation. It is entirely a practical work, written for the guidance of engineers and others familiar with the locality, and treats the subject from a purely utilitarian standpoint.

Naini Tal is a lake in the north-west provinces of India on the flanks of the Himalaya. There is a hill station located here, but the district suffers somewhat from the frequency of landslips. It is, indeed, probable that the lake owes its origin to the damming up of a stream by a great landslip, as was suggested by Dr Ball in 1878, though his views have not been universally accepted.

The object of the investigation, of which this report is the outcome, was to discover the cause of the instability of the hill-slopes in the district, to determine the extent of the insecure sites, and to suggest means for increasing their stability.

The methods adopted by the author were the following:—

(1) On a large scale (20″ to 1 mile) contoured map were inserted details of the distribution and petrological characters of the rocks.

(2) The angle of repose of the rocks under different conditions was determined.

(3) Cross-sections were constructed from the map showing the slope along the selected lines, and the portions of the rock lying outside the lines of safety were determined from the angles of repose.

The direction of the movements is shown in the report to be governed by the direction of the stratification planes, which in many areas have a dip in the same direction as the slope of the hill-sides but smaller in magnitude.

The rocks most affected are shales and dolomitic sandstones, and the lubricant is provided by the decomposition of the rock, which is brought about by water percolating along the stratification planes, and forming in the first instance a slippery clay, and in the second a layer of loose sand.

The great difference between the angle of repose of dry broken

slate and that of the same material when disintegrated and wet, is shown by the fact that the former will stand at an angle of 37°, while the angle of rest of the latter is not more than 16°, and the author points out that "the maximum angle of safety of interbedded rocks is determined by that of the weakest constituent."

The author devotes a few pages to the classification of the landslips according to Heim's scheme, and proceeds to describe the warnings which foreshadow a landslip, such as the opening of cracks parallel to the strike of the beds and changes in the courses of streams. Besides landslips of the ordinary type there occur subsidences caused by the removal in solution of the dolomitic cement of the sandstones and the consequent settling down of the loose material.

The most efficient methods of preventing the landslips appear to be the provision of means for the removal of the rain-water before it can percolate into the ground, and also for the discharge of subterranean water by the construction of adits.

The Report concludes with a detailed description of three particular sites, whose characters illustrate the results of the various forces described by the author. The value of the work is increased by the well-drawn diagrams and sections, and by the excellent map for which a special survey was made; but it may be worth while to ask whether such terms as 'demi-official' and the contraction 'para' for paragraph are improvements on the conventional modes of expression.

INVESTIGATIONS INTO APPLIED NATURE. By William Wilson, Junior. 8vo, pp. viii., 143. London: Simpkin, Marshall & Co., 1896.

THIS little book hardly calls for serious review. The author may be a pleasant enough companion in a country walk, if one were willing to be a little bored, and may also have certain powers of observation, but he is unable to arrange his matter in book-form or to express himself in English. The book is a strange conglomeration. The first few chapters relate to "Our Indigenous Flora as Food-Plants"; "On the Habits and Instinct of the Rook"; "Our Birds and their Functions"; "The Potato Disease"; and so on. The first paper has already been inflicted upon the British Association, another on the Inverness Scientific Society, and another on the Keith Literary Institute. Of pasture plants Mr Wilson says, "We have not as much in general use, taking the knowledge of variety as known to the average agriculturist into account, as we can scarcely say there is any variety in them." And speaking of the winter food of animals, "We find that human ingenuity has invented a large number of so-called spices or condiments to assist in feeding and keeping them (besides the fields' produce, turnips and straw), and are generally used." The funniest chapter is that on the crow, which, "like most objects of natural history, is very imperfectly understood." It seems to be a selfish and quarrelsome bird, but wily withal; "unusual operations on the part of man on the top of a stack is watched by the rook with suspicion, and in nine cases out of ten that stack will be avoided by them." "Atmospheric changes produce a very marked effect on them. There is no doubt but this causes the peculiar reeling in the atmosphere [!]. Before rainfall a dulness passes over them, early brightening up after the

rain is over. Late out of doors, so to speak, before snowstorm, and the same again before a thaw in many cases." Dealing "with the horses of Britain, it is supposed that they were first introduced by Julius Caesar into history." The hackney "is a class of beast well adapted for many requirements to which horseflesh has been attached to"; and the sheep, "our most arduous animal inhabitant of pastures." In his preface the author congratulates the public generally on the spread of technical education and the increasing association of agriculture and pure science. We regret that we cannot congratulate either the author or the public on the appearance of these "Investigations," which tend to the advancement neither of pure nor applied Science.

A Malagasy Geology

Geology. Nataon-d Rev. R. Baron, F.G.S., F.L.S. Vol. I. Nohazavain' ny Sary 51. Pp. vii. + 91, with 51 figs. Antananarivo: London Missionary Society's College, 1896. Price, 6s.

This very interesting production of the London Missionary Society's press is the first and possibly the last geological work in Malagasy that we shall see. The author divides his work into three sections and twenty-five chapters, and deals with mineralogy, and the dynamics of volcanic, metamorphic, and sedimentary rocks, with notes on the several districts from personal observation and otherwise. Vol. II. is promised, and will deal with the fossils. As it is difficult to give a fair criticism on a book written in Malagasy we can only offer a specimen of the author's easy style:—"Koa ny horohorontany dia fipararetan' ny hoditry ny tany, fa mievotrevotra ka manalonalona hoatra ny rano izy, ary ny toetran' izany fievotrevony izany dia tahaka ny fitopatopan' ny alon-drano hiany. . . ."

Scraps from Serials

In the last number of *La Feuille des Jeunes Naturalistes* (No. 323, Sept. 1897), M. L. Vignal concludes his notes on the fossil shells of the family Cerithiidae from the Eocene of the Paris Basin, this final instalment being illustrated by two photograped plates.

In the *Scottish Medical and Surgical Journal* for September Prof. Cossar Ewart prints his address delivered at the Graduation Ceremonial in the Edinburgh University last July. He announces that he has "practically proved that, notwithstanding the statements of Weismann and the experience of scientific German breeders, there is apparently such a thing as Telegony." He promises to contribute a note on the subject to the next number of the same journal.

New Serials

Messrs Schleicher Frères of Paris announce a forthcoming international journal for zoology, botany, physiology, and psychology, entitled *Intermediare des Biologistes*. It is to appear on the 5th and 20th of each month, under the editorship of M. Alfred Binet. The price and the date of the first issue are not yet decided.

According to *Science*, a small scientific monthly of a popular character has been established at De Land, Fla., entitled *Studies from Nature*.

A syndicate in Boston has purchased the *American Naturalist* from the executors of the late Professor Cope, and the September number is the first issue under the new management. Dr Robert P. Bigelow is now chief editor.

Further Literature Received

Elements of the Comparative Anatomy of Vertebrates, adapted from the German of R. Wiedersheim by W. N. Parker, ed. 2: Macmillan. Volcanoes of North America, I. C. Russell: Macmillan. Guide to Zermatt and the Matterhorn, E. Whymper: Murray. The New Psychology, E. W. Scripture: W. Scott. A Critical Period in the Development of the Horse, J. C. Ewart: A. & C. Black. Beiträge zur Dioptrik, A. Kerber: Fock.

Variations in the Spinal Nerves of *Hyla aurea*, G. Sweet: *Proc. R. Soc. Victoria.* Affinities of *Tarsius*, C. Earle: *Amer. Nat.* Princeton Contributions to Psychology, vol ii., Nos. 1, 2. Baeveren i Norge, R. Collett: *Bergens Mus.* Field Columbian Museum, Chicago, Geol. Series, No. 18; Zool. Series, Nos. 19, 20; Anthrop. Series, No. 16. U.S. Dept. Agriculture, Rep. No. 9. Australian Mus., Sydney, mem. No. ii. (Atoll of Funafuti). Journ. Marine Biol. Assoc., vol. v., No. 1. U.S. Bureau of Ethnology, 14th and 15th Ann. Reports. Roemer Mus. Hildesheim, mitth. No. 9. The Glacio-marine Drift of the Vale of Clwyd, T. M. Reade: *Quart. Journ. Geol. Soc.* Anatomy of *Apera burnupi*, W. E. Collinge: *Ann. Mag. Nat. Hist.* Australian Termitidae, pt. ii., and other papers, W. W. Froggatt: *Proc. Linn. Soc. N.S. Wales* and *Agric Gazette.* Glacial Observations in the Umanak District, Greenland, G. H. Barton: *Technol. Quarterly.* The Diplochorda, A. T. Masterman: *Quart. Journ. Micro. Sci.* Ann. Rep. Trustees S. African Mus., 1896. Ratzel's History of Mankind, English Trans., pt. 20: Macmillan. Journ. Coll. Sci. Imp. Univ. Japan, vol. x., pt. 2. Bull. Nat. Hist. Soc. New Brunswick, No. xv.

Shooting Times, Aug. 21; Newcastle Courant, Aug. 21; Pharmaceutical Journ., Sept. 4; Amer. Geol., Sept.; Amer. Journ. Sci., Sept.; Amer. Nat., Sept.; L'Anthropologie, July-Aug.; Feuille des Jeunes Nat., Sept.; Irish Nat., Sept.; Journ. Essex Techn. Lab., May-July; Journ. Malacol., July; Knowledge, Sept.; Literary Digest, Aug. 14, 21, 28, Sept. 4; Naturae Novit., July-Aug.; Naturalist, Sept.; Nature, Aug. 19, 26, Sept. 2, 9, 16; Nature Notes, Sept.; Naturen, Aug.; New Age, Aug.; Photogram, Sept.; Psychol. Rev., Sept.; Review of Reviews, Aug.; Rev. Scient., Aug. 21, 28, Sept. 4, 11; Rev. Sci. Nat. Quest., vol. vii., No. 1; Science, Aug. 13, 20, 27, Sept. 3; Sci. Gossip, June-Sept.; Sci. Amer., Aug. 14, 21, 28, Sept. 4; Scot. Geogr. Mag., Sept.; Scot. Med. and Surg. Journ., Sept.; Victorian Nat., July; Westminster Review, Sept.

OBITUARIES

SAMUEL ALLPORT

BORN JANUARY 23, 1816. DIED JULY 7, 1897

WE learn from the *Geological Magazine* of the death of the veteran petrologist, Mr Samuel Allport, who was one of the pioneers in the microscopical study of thin sections of rocks, and one of the most generous helpers of the younger generation studying his favourite subject. He was born in Birmingham, where he resided for the greater part of his life. For eight years only he was absent as manager of a business at Bahia, in Brazil, and there he made his first original observations on geology, collecting the cretaceous fossils from the coast near Bahia and contributing a paper on the subject to the Geological Society in London in 1860. On returning again to Birmingham his interest was excited by the work of Dr Sorby on the microscopical study of rocks, and thenceforward he became an accomplished petrologist. He made his own sections with great skill, and amassed a large collection of slides. His papers, chiefly published by the Geological Society, were not numerous, but very valuable, and related almost exclusively to the structure of igneous rocks. In 1887 he received the Lyell Medal from this society in token of appreciation of his researches. In 1880 he quitted business occupations and became librarian of the Mason College, Birmingham, an office which he held for seven years, until failing health necessitated his retirement.

FRANCIS AURELIAN PULSKY

BORN 17TH SEPTEMBER 1814. DIED 9TH SEPTEMBER 1897

FRANCIS PULSKY, the great Hungarian patriot, and the friend of Kossuth, is dead. His political life needs no mention here. On his return to Austria after the Imperial pardon, he became Director in 1869, and in 1872 General-Director, of Hungarian Museums and Public Libraries. An archaeologist, Pulsky's chief claim to the remembrance of our readers is his "Copper Age in Hungary," which was published both in Magyar and German.

THOMAS BRUMBY JOHNSTON, the Queen's Geographer for Scotland, died at Edinburgh on September 9th, in his eighty-fourth year. He was the last of the firm, of which he became a partner in 1852.

SIR EVERETT MILLAIS died on September 7th. He was born in 1856, and paid especial attention to the breeding of dogs and stock, and for some time was editor of *The Stock Breeder*.

NEWS

The following appointments are announced :

Dr Rodet to be professor of bacteriology in the University of Lyons ; Dr W. Ernest Thomson to the chair of physiology in the Andersonian College, Glasgow ; Dr Alfred Osann to be teacher of mineralogy in the Chemical School of Mülhausen ; Prof. Raphael Blanchard to be ordinary professor of botany in the Medical Faculty of Paris ; Prof. Vladimir I. Belajeff, professor of botany in the University of Warsaw, to be director of the Botanical Garden in the same city ; Prof. Vladimir I. Palladin, of Kharkoff, to be director of the Pomological Garden at Warsaw ; Dr H. V. Neal, of Harvard, to be professor of biology at Knox College, Galesburg, Illinois ; Prof. George Ruge, of Amsterdam, to be professor of anatomy and director of the Anatomical Institute at Zurich ; Dr Joseph Baldwin and Wm. S. Sutton as professors, and W. W. Norman, as assistant-professor, of biology in the University of Texas ; Dr H. Fling, professor of biology at the Oshkosh Normal School ; Prof. H. de Vries and Prof. Ph. Stohr to be professors of botany and anatomy in the University of Würzburg ; Miss A. A. Smith as assistant in botany in Mount Holyoke College, Mass. ; Ernest Wm. MacBride as professor of zoology in McGill University ; and Dr Kihlman as assistant-professor of botany in the University of Helsingfors.

Women are now admitted to the College of Physicians in Chicago.

Mr Alex. White is the recipient of the silver medal of the Zoological Society as a reward for his researches in the fauna of Nyassaland.

Dr O. F. von Moellendorff, the well-known conchologist, formerly German Consul at Manilla, has removed to the German Consulate at Kovno, Russia.

Professor R. Koch has returned to South Africa to continue his experiments on the nature of the rinderpest. The conference of the South African States on this great scourge was held in Pretoria during the first week of August last.

The Cothenius Gold Medal of the Imperial Leopold-Caroline Academy has been awarded to Prof. Albert von Kölliker, the veteran anatomist of Würzburg. The Baly Medal of the Royal College of Physicians of London has been presented to Prof. E. A. Schäfer in recognition of his important researches in physiology.

The first Flückiger Medal—an honour to be awarded every five years by the German and Swiss Pharmaceutical Societies alternately—has been presented to Mr Edward Morell Holmes, Curator of the Museum of the Pharmaceutical Society of Great Britain. A short account of Mr Holmes' work in botany, illustrated by an excellent portrait, appears in the *Pharmaceutical Journal* for Sept. 4.

Mr William Shaus of Twickenham, late of New York, has presented his collection of tropical Lepidoptera, comprising over 10,000 specimens, to the American Museum of Natural History. Mr E. A. Hoffman has also presented to the same museum his collection of North American Lepidoptera.

According to the *Revue Scientifique*, the late M. J. Jackson left a legacy of 100,000 francs each to the Geological Society of France, the French Association for the Advancement of Science, and to other similar bodies.

The Brazilian Government has decided to offer two prizes of $110,000 each to the discoverer of a bacillus of yellow fever and its precise characters, and to the investigator who shall determine the most efficacious means of dealing with the disease. The Medical Institute of Rio de Janeiro, the Pasteur Institute of Paris, and the Hygienic Institute of Berlin are conjointly to make the award. Dr Sanarelli is likely to be recipient of the first prize.

Dr H. H. Field's Concilium Bibliographicum is again showing promising activity. We have received a parcel of slips relating to the contents of *Natural Science*. Dr Field is, we are glad to say, restored to health.

A bronze statue was unveiled at Crevalcore, near Bologna, on Sept. 8, to Marcello Malpighi, the famous anatomist and microscopist. Dr Vallardi promises a volume "Malpighi e l'opera sua" as a memorial of the event.

The University of California, having $4,000,000 promised or received, has advertised for plans, the competition for which is international.

Science states that Peoria, Illinois, is to have a University on the death of Mr Washington Corrington of that city, who is now eighty-five years of age, and will leave a sum of over $1,000,000 for the new foundation.

Various donors have subscribed $100,000 to Hope College, Holland, Mich. The Laman Missouri Educational Association has received a gift of $10,000 from Mr D. A. Beamer.

The Indiana Academy of Science is now receiving State aid in the printing and publication of its *Proceedings*. It now holds much the same relation to the State that the National Academy of Sciences bears with respect to the Congress of the United States.

A bill for providing for a geological survey of the State of West Virginia was passed by the legislature last session. The commissioners will be the governor, treasurer, and president of the West Virginia University, the president of the State Board of Agriculture, and the director of the West Virginia Agricultural Experiment Station, who will serve without compensation, except out-of-pocket expenses. They will appoint a geologist of repute and such assistants as may be necessary. The survey is to examine the geological formation of the State, with especial reference to economics; soils and adaptability to particular crops; forests; physical features with reference to occupations, industrial development, and prosperity of the people; and to make geological and economic maps, and special reports on the geology and resources.

The American Association for the Advancement of Science will meet next year—its fiftieth anniversary—at Boston, under the presidency of Prof. F. W. Putnam. The Vice-Presidents for the sections are as follows:—Geology, H. L. Fairchild of Rochester; Zoology, A. S. Packard of Providence; Botany, W. G. Farlow of Cambridge; Anthropology, J. McKeen Cattell of New York City. Mr L. O. Howard of Washington was elected Permanent Secretary. A considerable number of papers have already been entered, a full list of which will be found in the *American Journal of Science* for September.

Apart from the President's Address, the addresses of the Presidents of the Section, especially interesting to the readers of this Journal, are those of Dr G. M. Dawson, Prof. Miall, Dr Keltie, Sir Wm. Turner, Prof. Michael Foster, and Dr Marshall Ward. Dr Dawson dealt with the Ancient Rocks of North America, tracing the history of the discovery, differentiation, and classification of the Palaeozoic formations. Prof. Miall protested that we study animals too much as dead things, and are content, many of us, to name and arrange them, according to our own notions of their likeness or unlikeness, and to record their distribution. Dr Keltie gave a sketch of recent progress in

geography, and pointed out directions for further work. Sir William Turner's paper dealt with distinctive characters of human structure, and was largely concerned with the erect attitude. Prof. Michael Foster reviewed the progress of Physiology since the Association last met in Canada, in 1884, and Dr Marshall Ward gave a long and interesting paper on the economics of Fungi.

"THE GLOBE" of Toronto provided a good account of the proceedings of the Association, and illustrated it with amusing portraits and interesting information; one of the series of pictures gave the coats of arms of past presidents. The Honorary LL.D. of Toronto University was conferred on Lords Kelvin, Rayleigh and Lister, and on Sir John Evans; the D.C.L. of Trinity on Lords Kelvin and Lister, Sir John Evans, Sir Wm. Turner, and Sir George Scott Robertson. The following grants were made to Committees of Biology and Geology:—Seismological Observations, £75; Erratic Blocks, £5; Investigation of Coral Reefs, £40; Geological Photographs, £10; Age of rocks near Moreseat, £10; Pleistocene fauna and flora of Canada, £20; Table at Naples Zoological Station, £100; Table at Plymouth, £20; Index generum et specierum Animalium, £100; Biology of Ontario Lakes, £75; Oysters, £30; Climatology of Tropical Africa, £30; North-Western Tribes of Canada, £75; Glastonbury Lake Village, £37, 10s.; Ethnography, £25; Silchester excavations, £7, 10s.; Ethnology of Canada, £75; Torres Straits Expedition, £125; Changes of nerve cells, £100; Fertilization in Phaeophyceae, £15. The total amount granted was £1350. The total attendance numbered 1362.

WE understand that, after various delays, the fitting and arrangement of the new Paris Museum of Natural History are now making good progress. It is hoped that the public galleries will be ready for opening early next year.

WE hear from *Science* that plans have been submitted to the Department of Buildings, New York, for two additions to the American Museum of Natural History—one, a lecture hall at the north end of the Museum; the other, a six-story building attached to the west wing.

THE Report of the Trustees of the South African Museum, Cape Town, for 1896, received this month, records the re-organisation of the staff and the completion of the new buildings, to which we have previously referred. The Museum now has the services of Mr W. L. Sclater as director; Mr L. Peringuey as assistant-director, with special charge of the insects; Dr W. F. Purcell as keeper of land invertebrates; Dr G. S. Corstorphine as keeper of geology and mineralogy; and Dr J. D. F. Gilchrist as honorary keeper of marine invertebrates. During the year 1896 a special grant was expended upon the purchase of a series of large mammals for the collection, while an exchange with the La Plata Museum furnished an important series of South American mammals and birds. Large acquisitions of European rocks and fossils were also purchased for comparison with the South African specimens.

WE have received from Dr J. W. B. Gunning, Director of the Museum of the South African Republic, Pretoria, a list of acquisitions for the month of July 1897. The Zoological Department is being especially enriched with examples of the South African fauna.

THE trustees of the Albany Museum, Grahamston, have decided to erect a new and more commodious building. The necessary funds are already in hand, and the work is to be proceeded with at once. The plans have been prepared by Mr Viesebosse, architect of the Cape Town Museum. The new museum will be a two-storied building, 150 feet long by about 60 feet deep.

WE have received the first annual report of the Geological Survey of Cape Colony, under the direction of Prof. G. S. Corstorphine. The new department seems to be much hampered by a clamour for immediate economic results. We

hope the Colony will not be too impatient, but realise that the purely scientific part of the survey must first be accomplished in more or less detail before the economic problems can be satisfactorily attacked.

According to the *American Naturalist*, the Academy of Natural Sciences of Philadelphia is trying to raise $50,000 to purchase the palaeontological collections of Professor Cope. Since the fund received from the sale of the collection is to go to the Academy for the foundation of a professorship of palaeontology, it would seem appropriate that the collections themselves should become the property of this society.

We have received the last part of the *Bulletin* of the Natural History Society of New Brunswick (No. XV.), containing a long review of the scientific work of Abraham Gesner, pioneer in the geology and mineralogy of Nova Scotia, by Dr G. F. Matthew. Dr Matthew also describes supposed evidence of a thysanurous insect from the early Palaeozoic rocks (Little River Group) of New Brunswick. The thirty-fifth annual report of the Society makes the gratifying announcement that the membership has considerably increased during the year. The library also increases rapidly, and H.M. Treasury has generously presented to it a complete set of the 'Challenger' Reports.

We have received from Mr C. A. Snazelle, the energetic honorary secretary of the Jersey Natural Science Association, a report of the second meeting of this new society, and the first programme for the winter's meetings. In addition to the meetings for general papers and lectures, there will be small sectional committees for various departments of detailed scientific work. We regret to learn that Natural Science is so little cultivated in Jersey that the total membership of the Society is still less than 50.

Mr William Bidgood, the Curator of the Museum of the Somersetshire Archaeological and Natural History Society, in Taunton Castle, has just issued the sixth edition of his Guide. The Museum is chiefly remarkable for its archaeological collection relating to Somersetshire, while among the geological specimens are the cave remains from Banwell, Bleadon, Sandford Hill, and Hutton.

The total number of visits of students to the reading-room at the British Museum during the year was 191,363, being 3,600 less than that of 1895, which again was lower than that of 1894 by 8,000. This we regard in a very favourable light, as it shows that the wise regulations of Sir Maunde Thompson, regarding a certain class of readers, have resulted in greater comfort for the more serious students. It also shows indirectly the value of Free Libraries.

The last number of the *Journal* of the Marine Biological Association of the United Kingdom (vol. v., No. 1, issued August 1897) contains the annual report of the Director and of the Council for 1896-97. Under the direction of Mr Allen the Plymouth station continues to flourish and increase in utility. The Association is also fortunate in retaining the services of Mr Holt, for the time being, as Honorary Naturalist. The Lords Commissioners of H.M. Treasury in granting the usual £1000 for the year 1897-98, have made it a condition that the Association will give all the assistance in its power to the Inspectors of Irish Fisheries in investigations which they desire to be made on the habits and migrations of the mackerel visiting the Irish coast. This important work has thus been begun, and the principal contribution to the new number of the *Journal* is Mr Allen's report on the present state of knowledge with regard to the habits and migrations of the mackerel (*Scomber scomber*). Most of the other papers also have an important economic bearing. The large laboratory in the Plymouth station has been provided with a new flat tank, eight feet by five feet and eight inches deep, in which Mr Garstang has been making the observations on crustacea to which we refer elsewhere. The sea-water supplied to the laboratory is still kept distinct from

the general circulation in the show tanks, and is never returned to the laboratory tanks after it has passed through them. Experience shows that the theory of 'circulation,' as applied to aquaria, is illusory and in practice disastrous.

Science announces that the Zoological Expedition sent by Columbia University this summer to Alaska have lost all the results of their season's work by the wreck of the *City of Mexico*, in which they were returning. Fortunately all the members of the party were landed in safety. The Duke of the Abruzzi and his companions successfully ascended Mount St Elias on July 30, 31. The height of the mountain was ascertained to be 18,100 ft. Dr Sella was of the party and we may hope for excellent photographs as illustration to the report of the expedition.

We are indebted to Mr Duerden for an interesting account of this summer's work of Prof. W. K. Brooks' party of Baltimore students in studying the tropical life of Jamaica. As we have previously announced, the party this year was under the direction of Prof. J. E. Humphrey, and established a temporary laboratory in an hotel at Port Antonio, a locality in many respects more advantageous than Port Henderson, the former headquarters. The director, one of the most distinguished of the younger American botanists, collected and preserved a large amount of botanical material, giving special attention to the shell-perforating algae and to the embryology of certain flowering plants. We deeply regret to add that towards the end of the course of study he became ill and died almost immediately. Another botanist, Mr A. Fredholm, dried a large collection of Jamaica plants for the herbarium of the U.S. National Museum. Dr F. S. Conant continued his researches on the medusae, begun last year. The chief object of his investigation this season was the function of the sensory organs of the medusa, and material was prepared with especial reference to a study of the changes, under the influence of light and darkness, in the pigment of the retina of the eyes. Dr H. L. Clark also continued his previous researches on the echinoderms. He devoted special attention to the life-history of the interesting holothurian *Chirodota*. Mr Sudler returned to Port Henderson to dredge for the small crustacean *Lucifer*, which he could not find at Port Antonio. Mr Grave studied various ophiurans, and doubled the number of species recorded from Jamaica. The eggs of one species were artificially fertilised in the laboratory, and a complete series of the embryos from the single cell to the fifteen-day Pluteus stage was satisfactorily preserved for future examination. Mr E. N. Berger devoted his time chiefly to insects and arachnids, obtaining many embryonic stages, especially of a pseudoscorpion, probably *Obisium*. There were also junior students. Mr Duerden, as Curator of the Jamaica Institute, was invited to join the party ; he profited by the occasion in enriching the Museum collection, and in continuing his researches on the corals.

ERRATA

Page 88, line 3.	*For*	'invariable'	*read*	'variable.'
,, 148, ,, 6.	,,	'Marlott'	,,	'Marlatt.'
,, 158, ,, 12.	,,	'collection'	,,	'collector.'